USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

CENTRO INTERNACIONAL DE ESTUDOS DE DOUTORAMENTO E AVANZADOS DA USC (CIEDUS)

TESE DE DOUTORAMENTO

HUMAN WELL-BEING IN A CHANGING MARINE SOCIAL-ECOLOGICAL SYSTEM

A PARTICIPATORY AND INTERDISCIPLINARY ANALYSIS USING THE ECOSYSTEM SERVICES CONCEPT

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ESCOLA DE DOUTORAMENTO INTERNACIONAL

PROGRAMA DE DOUTORAMENTO EN CIENCIAS MARIÑAS, TECNOLOXÍA E XESTIÓN

SANTIAGO DE COMPOSTELA

2019

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Human well-being in a changing marine social-ecological system: a participatory and interdisciplinary analysis using the ecosystem services concept

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Que a presente tese, correspóndese co traballo realizado por D. João Manuel Garcia Rodrigues, baixo a miña dirección, e autorizo a súa presentación, considerando que reúne os requisitos esixidos no Regulamento de Estudos de Doutoramento da USC, e que como director desta non incorre nas causas de abstención establecidas na Lei 40/2015.

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A Inês.

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Agradecimentos

A Inês, por tudo. Sem ela esta tese não teria visto a luz do dia. À minha família, por desde cedo me ter dado a liberdade de fazer tudo o que queria, com tudo o que isso implica. A Sebastián, pela motivação constante e por estar sempre disponível a ajudar, sobretudo nos momentos mais difíceis. A Isabel, pelo interesse na minha investigação e por ter criado as condições para que grande parte do trabalho de campo desta tese se concretizasse. A todos os pescadores e vendedoras de pescado de Esposende cuja dignidade e perseverança são motivo de admiração e inspiraram esta tese. Às representantes do Município de Esposende, Instituto da Conservação da Natureza e Florestas, operadores marítimo-turísticos e investigadoras pela gentileza de concederem entrevistas, participarem em grupos focais e demais exercícios participativos que alicerçam esta tese. A Klara e Maria, por me contagiarem com a sua determinação, energia e amabilidade em variados momentos desta caminhada.

A todos as pessoas que lutaram e continuam lutam pelo ensino público e universal. Sem elas muitos de nós viveríamos ainda imersos no obscurantismo.

Obrigado.

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Resumo

Como é afectado o benestar humano polos efectos das áreas mariñas protexidas? Esta é a cuestión que tento responder nesta tese. Sen pór en dúbida o principal obxectivo das áreas protexidas—protexer e conservar a biodiversidade—, investigo de que formas os grupos sociais dependen, percepcionan e se relacionan co Litoral Norte—unha área mariña protexida localizada no norte de Portugal. Creo que este é un tópico que merece ser entendido con profundidade, unha vez que o número e extensión de áreas mariñas protexidas ten vindo a crecer en todo o mundo. Así mesmo, a creación de novas áreas mariñas protexidas é frecuentemente promovida por Estados ou organizacións non-gobernamentais como unha estratexia para salvagardar tanto a biodiversidade mariña como o benestar das comunidades costeiras. No entanto, aínda que sexan ben coñecidos os efectos positivos que as áreas mariñas protexidas poden traer á biodiversidade, é aínda incipiente o coñecemento sobre os seus efectos positivos e negativos no benestar humano. San particularmente descoñecidos os efectos das áreas mariñas protexidas nas dimensións sociais, culturais e terapéuticas do benestar humano. Antes de avanzar para as preguntas específicas de investigación que coloco nesta tese, poño primeiro en contexto os tópicos de investigación aqui abordados.

Abordaxe teórica

Esta tese asenta na teoría dos sistemas socioecolóxicos. A teoría dos sistemas socio-ecolóxicos creceu con contribucións das ciencias naturais e sociais, como a Ecoloxía de Sistemas, Bioloxía da Conservación, Economía Ecolóxica, Ecoloxía Política, entre outras. Considero que esta tese segue a tradición interdisciplinaria da teoría dos sistemas socioecolóxicos xa que fai uso de abordaxes teóricas e metodolóxicas tanto das ciencias naturais como das ciencias sociais. A abordaxe socioecolóxica recoñece que as persoas moldean e son modeladas polo ambiente onde actúan, así como polas estruturas, procesos e funcións ecolóxicas dos ecosistemas. Neste contexto, as políticas dirixidas para a conservación da biodiversidade teñen tamén unha dimensión humana pois afectan as comunidades humanas que dependen directa ou indirectamente das áreas a conservar. Estudar as dimensións humanas afectadas por políticas de conservación da biodiversidade implica entender as percepcións, necesidades e aspiracións que os distintos grupos sociais teñen sobre esas políticas. Implica tamén entender posíbeis fontes de conflito social e explotar camiños que leven á compatibilización entre a conservación da biodiversidade e o benestar humano. De seguida, desenvolvo con máis detalle a abordaxe teórica desta tese, con especial incidencia nos ambientes mariño e costeiros.

SISTEMAS SOCIOECOLÓXICOS

Berkes et al. (2000) cunharam o termo "sistema socioecolóxico" para destacar a inter-relación entre humanos e ecosistemas. Tradicionalmente os sistemas ecolóxicos e sociais son estudados separadamente. Mentres que biólogos e ecóloxistas concentran os seus estudos nas estruturas, procesos e funcións ecolóxicas, antropólogos, xeógrafos, economistas, entre outros, céntranse nos sistemas sociais. No entanto, as interaccións socioecolóxicas permanecen pouco comprendidas como resultado da separación artificial entre seres humanos e natureza na investigación científica. Para comprender mellor as interaccións socioecolóxicas, existen cada vez máis estudos interdisciplinarios que combinan coñecemento tanto das ciencias naturais como

sociais. A investigación interdisciplinaria ten axudado a desvelar propiedades importantes dos sistemas socioecolóxicos (Liu et al., 2007; Pollnac et al., 2010; Leslie et al., 2015). Estas propiedades inclúen as súas dinámicas non-lineares retroaccións, heteroxeneidade, sorpresa, límites e resiliencia (Liu et al., 2007). O estudo destas propiedades permite desvelar a natureza complexa dos sistemas socioecolóxicos e contribúe con coñecemento importante para as políticas de conservación.

ÁREAS MARIÑAS PROTEXIDAS

As áreas mariñas protexidas son ferramentas de conservación que poden afectar tanto os ecosistemas, como as persoas que deles dependen (Ban et al., 2017). É, por tanto, útil consideralas intervencións de conservación en sistemas socioecolóxicos complexos. Isto significa que é igualmente importante entender os grupos sociais e sistema de gobernanza —con súas regras e institucións formais e informais—, así como as especies e as estruturas, funcións e procesos ecolóxicos que ocorren na área protexida. A boa gobernanza é particularmente importante para decisións transparentes, lexítimas e democráticas. As percepcións positivas sobre a gobernanza de áreas protexidas polos grupos sociais afectados por medidas de conservación levan xeralmente a que estes apoien iniciativas locais de conservación (Leleu et al., 2012; Bennett, 2019). A boa gobernanza depende xeralmente do envolvemento e deliberación dos grupos sociais na designación, planificación e xestión de áreas protexidas (Gleason et al., 2010; Sayce et al., 2013). O envolvemento dos distintos grupos sociais na creación e xestión de áreas protexidas—alén de ser un imperativo democrático—é tamén unha oportunidade para lidar mellor coa incerteza e imprevisibelidade dos sistemas socioecolóxicos (Gunderson and Holling, 2001). Así é porque a participación de grupos sociais diversos na toma de decisión aumenta a gama de coñecemento ecolóxico, social e institucional (Berkes, 2011). O envolvemento dos grupos sociais afectados polas medidas de conservación contribuíu para a gobernación e xestión eficaz de sistemas socioecolóxicos mariños complexos, como é o caso de áreas mariñas protexidas.

En 2019, existían cerca de 17 000 áreas mariñas protexidas en todo o mundo. Estas ferramentas de xestión mariña cobren cerca de 8% da área de todos os océanos, ou 28 millóns de km² da superficie mariña do planeta (UNEP-WCMC and IUCN, 2019). As áreas mariñas protexidas teñen, en media, unha área reducida—3,3 km2 (Boonzaier and Pauly, 2016)—, mais poden atinxir 1 976 000 km2, o tamaño de Marae Moana, unha área protexida pertencente ás Illas Cook. A creación recente de grandes áreas mariñas protexidas (> 10.000 km2), principalmente en alto-mar, ten permitido a aproximación das metas internacionais que visan protexer efectivamente 10% dos océanos até 2020 (Aichi Target 11).

As áreas mariñas protexidas nas cales son permitidas actividades extractivas como a pesca, e onde o cumprimento de regras e monitorización é feita de forma rigorosa, protexen efectivamente a biodiversidade mariña, aumentando a biomasa, abundancia e diversidade das especies, en comparación con áreas sen protección (Lester et al., 2009; Edgar et al., 2014). Aínda que as áreas mariñas altamente protexidas, ou sexa, as categorías I e II da IUCN, conseguen protexer efectivamente a biodiversidade mariña, é sabido que as áreas con graos inferiores de protección son xeralmente menos eficaces (Ban et al., 2014). As áreas mariñas protexidas tamén contribúen para o benestar humano: unha revisión recente de 118 artigos científicos concluíu que metade dos resultados documentados sobre benestar humano eran positivos, mentres que un terzo documentaba resultados negativos (Ban et al., 2019). Como as áreas mariñas protexidas poden causar tanto efectos positivos como negativos nas comunidades costeiras, o éxito a longo prazo das áreas mariñas protexidas depende xeralmente da aceptación, apoio e participación da poboación local na xestión desas áreas (Pita et al., 2011; Voyer et al., 2015; Yates et al., 2019).

SERVIZOS DO ECOSISTEMA

O concepto de "servizos do ecosistema" é útil para entender as interdependencias entre os seres humanos e os ecosistemas. Os servizos do ecosistema poden ser definidos como "as características, funcións ou procesos ecolóxicos que contribúen directa ou

indirectamente para o benestar humano, ou sexa, os beneficios que as persoas obteñen de ecosistemas funcionades" (Costanza et al., 2017). Eses beneficios para o benestar humano son complexos, non-lineais, dinámicos, xeralmente son co-producidos por elementos culturais e sociais e influenciados polos sistemas de gobernanza (Reyers et al., 2013; Primmer et al., 2015; Palomo et al., 2016). O concepto de servizos do ecosistema xurdiu dunha crecente necesidade de recoñecer a importancia dos ecosistemas nas políticas públicas.

Cales son as vantaxes e desvantaxes de aplicar o concepto de servizos do ecosistema nas prácticas e políticas de conservación da biodiversidade? Antes de máis, convén salientar que a conservación da biodiversidade precisa dun amplo apoio social para obter resultados sociais e ecolóxicos positivos (Bennett, 2016; Bennett et al., 2019). Para que iso aconteza, os valores da conservación e normas sociais a eles asociados necesitan chegar ao público en xeral, indo a súa defensa para alén de movementos ambientalistas e conservacionistas. Por outras palabras, a necesidade de conservar a biodiversidade necesita ser difundida e adoptada por un largo espectro da sociedade, o que esixe amplas mudanzas de normas sociais (Chan et al., 2017). Aínda que a normalización da conservación dificilmente resultase da investigación e prácticas asociadas á xestión de servizos do ecosistema, o concepto ofrece gran potencial na creación de normas para a conservación a través da xustiza, equidade e formación de valores conservacionistas (Jax, 2013; Chan et al., 2017).

A análise de servizos do ecosistema pode axudar a resolver cuestións de xustiza e equidade da conservación, xa que a súa análise pode permitir determinar de que forma é feito o acceso e a distribución dos beneficios dos servizos do ecosistema (Felipe-Lucia et al., 2015; Berbés-Blázquez et al., 2016). A incorporación explícita de cuestións de acceso, distribución e poder de decisión nas avaliacións de servizos do ecosistema en políticas de conservación pode axudar a fortalecer a lexitimidade da planificación e xestión de áreas protexidas. Alén do máis, a difusión da mensaxe de que os servizos do ecosistema contribúen para mellorar a vida das persoas pode crear un amplo sentido de responsabilidade social, contribuíndo así para evitar a destrución

ou a degradación das fontes de benestar humano, isto é, os ecosistemas (Chan et al., 2017).

A contribución do concepto de servizos do ecosistema para a formación de valores conservacionistas pode ser recoñecida a través de avaliacións rigorosas en iniciativas de conservación dos servizos culturais do ecosistema e dos seus valores (Chan et al., 2016). Os servizos culturais do ecosistema son, moitas veces, asociados a locais específicos, permitindo que as experiencias, capacidades e identidades das persoas sexan desenvolvidas e enriquecidas pola interacción con locais naturais. As nosas identidades, experiencias e capacidades moldean fortemente os nosos valores e normas sociais (Stern et al., 1999; Stets and Biga, 2003). Nese sentido, a reconexión á biosfera a través da visita e usufruto de áreas protexidas—moitas das cales promoven a educación ambiental, recreación e turismo da natureza—pode axudar a ampliar o apoio social a iniciativas de conservación da biodiversidade.

BENESTAR HUMANO

O concepto de benestar humano está no centro do concepto de servizos do ecosistema. O benestar humano pode ser definido como "un estado de estar cos outros e co medio ambiente, que xorde cando as necesidades humanas son atendidas, cando individuos e comunidades poden actuar de maneira significativa para perseguir os seus obxectivos, e cando individuos e comunidades gozan dunha calidade de vida satisfactoria" (Breslow et al., 2016). Esta definición evoca conceptualizacións sobre necesidades humanas (Max-Neef et al., 1990) e unha concepción eudemónica de benestar (Ryan and Deci, 2001). O concepto de benestar pode ser organizado en dominios, atributos e indicadores que parten de catro principios constituintes do benestar: condicións, capacidades, afinidades e dominios transversais (Breslow et al., 2016). As "condicións" están relacionadas con necesidades humanas básicas como por exemplo as calidades tangíveis do ambiente onde se vive, economía, seguranza ou saúde. As "capacidades" abranguen as formas de vida, liberdade e coñecemento, e inclúen unha concepción de benestar asente na vida plena (concepción eudemónica).

As “afinidades” abranguen a calidade dos relacionamentos coas persoas e coa natureza, e prácticas e identidades culturais a eles asociados. Os dominios transversais de benestar humano inclúen a equidade, xustiza, seguranza e a sostibilidade. Esta conceptualização de benestar humano presupon que as persoas moldean e son moldeadas pola natureza, e salienta a importancia de ecosistemas saudábeis e funcionades para que as xeracións presentes e futuras poidan prosperar.

Obxectivo e preguntas de investigación

Esta tese céntrase nos efectos positivos e negativos que as áreas mariñas protexidas causan nas múltiples dimensións de benestar humano. Para ese fin, aplico nesta tese o concepto de servizos do ecosistema como unha metáfora da dependencia do benestar humano en relación á natureza. Comprender os efectos dos resultados da conservación mariña no benestar humano é e será central para as prácticas e políticas de conservación. Especialmente se for tido en conta que o número e a extensión de áreas mariñas protexidas é cada vez maior.

As áreas mariñas protexidas son promovidas como estratexias eficaces para salvagardar a biodiversidade mariña e os medios de subsistencia das comunidades costeiras. No entanto, aínda que sexan ben coñecidos os principios-chave aos cales as áreas mariñas protexidas deben obedecer para salvagardar e protexer efectivamente a biodiversidade, escasea aínda coñecemento científico detallado sobre as dimensións sociais destas áreas. É aínda pouco comprendido de que forma as consecuencias das medidas das áreas mariñas protexidas afectan positiva e negativamente distintas grupos sociais que dependen dos servizos do ecosistema provisionados por estas áreas. Existe unha necesidade urxente de coñecemento científico máis detallado sobre como poden as áreas mariñas protexidas protexer efectivamente os medios de subsistencia das comunidades costeiras e promover o seu benestar. Aínda que os dominios do benestar asociados aos beneficios económicos e de gobernanza das áreas mariñas

protexidas son cada vez máis estudados, os dominios sociais, culturais e terapéuticos son aínda moi pouco investigados.

Para investigar os efectos das áreas mariñas protexidas nas múltiples dimensións do benestar humano, coloco as seguintes preguntas de investigación como punto de partida desta tese:

1. De que formas contribúe o Parque Mariño do Litoral Norte para o benestar subxetivo de residentes e visitantes? **(capítulo 2)**;
2. Como é percepcionada polos grupos sociais locais a gobernanza e xestión do Parque Mariño do Litoral Norte, especialmente polos grupos sociais máis dependentes dos recursos mariños e costeiros locais? **(capítulo 3)**;
3. Cales son as aspiracións dos grupos sociais locais para o futuro próximo ao Parque Mariño do Litoral Norte, e como se poden alcanzar esas aspiracións? **(capítulo 4)**;
4. Que leccións se poden aprender do estudo de caso do Parque Mariño do Litoral Norte para prácticas e políticas de conservación mariña? **(capítulos 2, 3** e **4)**.

Contribucións da tese

A contribución principal desta tese é mellorar a comprensión sobre as formas polas cales as áreas mariñas protexidas afectan múltiples dimensións do benestar humano. Para iso, recollín datos sobre percepcións e aspiracións de diversos grupos sociais que usan, xestionan, investigan, viven e visitan o sistema socio-ecolóxico abarcado polo Parque Mariño do Litoral Norte. No xeral, esta tese conclúe que as áreas mariñas protexidas de múltiples usos poden contribuír positivamente para diversas dimensións de benestar humano. Con todo, para que beneficios e tamén as consecuencias negativas destas áreas sexan partilladas de maneira equitativa entre os distintos grupos sociais, terase de ter en conta non só a biodiversidade, mais tamén consecuencias das accións de conservación para as múltiples dimensións do benestar de distintos grupos sociais. Neste ámbito, o desenvolvemento de procesos participativos inclusivos en torno ás prácticas e políticas de conservación ofrecen

oportunidades promisoras para afrontar desafíos locais, reducir conflitos, e aumentar o apoio social á conservación. De seguida, presento as tres principais conclusións desta tese.

Primeiro, as interaccións entre prácticas culturais e locais do Parque Mariño do Litoral Norte contribúen positivamente para distintas dimensións culturais do benestar humano **(capítulo 2)**. Existen, no entanto, diferenzas significativas nos niveis de benestar xerados explicadas por factores socioeconómicos e comportamentos ambientais. O benestar subxetivo proveniente de relacionar, interaxir e usufrutuar de locais do Parque Mariño do Litoral Norte pode ser agrupado en catro dimensións culturais de benestar. Con base nunha análise factorial exploratoria, interpretei estas dimensións como *envolvemento coa natureza & saúde*; *sentimento de lugar*; *illamento na natureza*; e *espiritualidade*. Esas dimensións culturais do benestar non son mutuamente exclusivas e poden reflexar elementos interdependentes de benestar humano.

Segundo, os efectos sociais e ecolóxicos das áreas mariñas protexidas poden ser percepcionados de maneira contraditoria por distintos grupos sociais **(capítulo 3)**. No Parque Mariño do Litoral Norte, mentres que os xestores da área protexida teñen percepcións tendencialmente positivas sobre os efectos das medidas de conservación, os pescadores, vendedoras de pescado, operadores marítimo-turísticos e científicos, teñen percepcións máis negativas sobre eses efectos. Estas percepcións contraditorias dos distintos grupos sociais debe constituír motivo de preocupación para o futuro do Parque Mariño do Litoral Norte. Esta preocupación decorre do feito de as percepcións negativas dos efectos da conservación estaren frecuentemente asociadas á falta de apoio e á reprobación das iniciativas de conservación por parte de grupos sociais locais.

Terceiro, articular as percepcións e aspiracións de pescadores, vendedoras de pescado, operadores turísticos, científicos e xestores do Parque Mariño do Litoral Norte en accións concretas de conservación pode aumentar o apoio social ao parque, así como axudar a mellorar o estado da biodiversidade local e o benestar dos distintos

grupos sociais **(capítulo 4)**. Articular percepcións e aspiracións en accións de conservación require procesos participativos que posibiliten a aprendizaxe, a discusión e a comunicación entre diversos grupos sociais. Require tamén a articulación de distintas cosmovisións, perspectivas, tipos de coñecemento e valores. Incluír a contribución de distintos grupos sociais nas decisións de conservación pode contribuír para o aumento da lexitimidade e da responsabilidade dos grupos sociais sobre as decisións tomadas. Isto porque a responsabilidade das decisións tomadas será tamén dos grupos sociais envolvidos na toma de decisión. A distribución xusta e equitativa dos beneficios e tamén dos efectos sociais negativos da conservación está máis próxima de ser alcanzada cando as decisións proveñen de procesos participativos inclusivos e democráticos. Decisións máis equilibradas están máis próximas de salvagardar tanto a biodiversidade como o benestar humano.

Recomendacións para prácticas e políticas de conservación

Os resultados desta tese ofrecen varias recomendacións para prácticas e políticas da conservación. Unha é que as avaliacións subxectivas de benestar humano poden revelar vínculos importantes entre as dimensións culturais de benestar e locais específicos das áreas protexidas. Ao dirixir políticas e accións de conservación para locais que combinan valores ecolóxicos e culturais excepcionais, os xestores das áreas protexidas poden encontrar unha maneira práctica de promover sinerxías entre a conservación da biodiversidade e o benestar humano. Protexer os locais das áreas protexidas que son importantes para o público—así como comunicar eficazmente co público a razón que xustifica cada medida de conservación—ofrece oportunidades promisoras para atraer o apoio e a participación do público ás decisións da conservación. O apoio e a participación pública son condicións necesarios para accións de conservación ben-sucedidas.

Outra recomendación ten que ver coas percepcións do público sobre os efectos sociais e ecolóxicos das áreas protexidas. Comprender as causas subxacentes ás

percepcións negativas é esencial para superar conflitos e problemas a elas asociadas. Por exemplo, no Parque Mariño do Litoral Norte, os decisores tenden a destacar o éxito da área protexida na protección de certos hábitats, creación de rutas costeiras para camiñantes, e a promoción da educación ambiental. Xa pescadores e vendedoras de pescado tenden a considerar a área mariña protexida unha ferramenta contra a pesca e unha estratexia para beneficiar o turismo. Alén dos decisores, todos os outros grupos sociais vinculan os efectos sociais e ecolóxicos negativos da área protexida a entrabes á participación nas decisións de conservación, capacidade de xestión limitada, planificación deficiente, e monitorización insuficiente. Os científicos enfatizaran a ausencia de mellorías ecolóxicas visíbeis. No xeral, ás perceções contrarias de decisores, usuarios locais e científicos compromete o apoio social ao Parque Mariño do Litoral Norte. Identificar e analizar os motivos por detrás destas percepcións opostas son os primeiros pasos para mellorar futuras medidas e políticas de conservación. Un paso promisor seguinte poderá ser considerar, discutir e articular o coñecemento de distintos grupos sociais para resolver desafíos concretos de conservación. Aínda que algunhas das contribucións dos grupos sociais poidan chocar cos obxectivos principais da conservación, articular as aspiracións que se aliñan cos presupostos da conservación e da sostibilidade pode ofrecer un gran potencial para novas solucións. Iso porque o coñecemento local é xeralmente moldeado polo ambiente e condicións locais e, por tanto, pode xerar solucións adaptadas aos problemas locais.

A participación de diversos grupos sociais locais na toma de decisión é crucial para o éxito da conservación. Esta é unha mensaxe frecuentemente repetida. E é seguramente moito máis fácil ser escrita do que ser feita. Porén, os esforzos para mellorar a comunicación e o entendemento mutuo entre xestores das áreas mariñas protexidas, pescadores, vendedoras de pescado, operadores marítimo-turísticos, científicos e outras partes interesadas relevantes, poden producir resultados positivos para iniciativas de conservación a longo prazo. O taller organizado no ámbito desta esta tese é diso exemplo. Ao crearen narrativas partilladas de visións futuras

positivas—e ao desenvolveren accións concretas para alcanzar o futuro previsto—os participantes do taller puideron discutir abertamente problemas locais e propor solucións concretas para superar eses problemas. A expansión e inclusión de procesos participativos semellantes nas prácticas e políticas de conservación—onde grupos sociais, xeralmente ausentes das decisións, están representados—pode xerar solucións máis transparentes, democráticas e duradeiras para os efectos sociais negativos que poden decorrer de medidas de conservación da biodiversidade.

Palabras chave: áreas mariñas protexidas; conservación; Litoral Norte; Portugal; sistemas socioecolóxicos; benestar humano; servizos do ecosistema; pesca; turismo; percepcións; gobernanza.

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Abstract

Marine protected areas are conservation initiatives whose primary goal is to safeguard marine biodiversity. But with the creation of regulations and restrictions, marine protected areas not only impact biodiversity, but also affect coastal communities whose livelihoods depend on locally provided ecosystem services. In fact, marine protected areas can be considered conservation interventions in complex social-ecological systems because they affect intricate interactions between biodiversity, ecosystem services and people. This means that it is important to understand not only the ecological outcomes of marine protected areas, but also their social dimensions. Yet their social dimensions—and specifically the ways marine protected areas affect positively and negatively human well-being—are still poorly known. This is a knowledge gap worth exploring because marine protected areas are increasingly promoted as marine management tools that safeguard both biodiversity and human well-being. As a result, their number and extent are growing worldwide.

So, how can multiple-use marine protected areas better account for human well-being? This is the guiding question of this thesis. Here I explore how people depend, relate to, perceive, and envisage Litoral Norte—a multiple-use marine protected area located in northern Portugal. I investigate the ways Litoral Norte support the subjective well-being of nearby residents and visitors **(chapter 2)**. I examine local

stakeholders' perceptions of Litoral Norte governance and management **(chapter 3)**. And I articulate the aspirations and positive future visions that local stakeholders have for Litoral Norte **(chapter 4)**. Overall, I try to improve the understanding of how the outcomes of a marine protected area affect multiple dimensions of human well-being.

I report three main findings in this thesis. First, interactions between cultural practices and Litoral Norte sites support different cultural dimensions of human well-being, with significant differences in levels of well-being explained by socio-economic factors and environmental behaviour. Subjective well-being derived from relating to, interacting with, and experiencing MPA sites can be grouped onto four cultural dimensions of well-being: *engagement with nature & health*; *sense of place*; *solitude in nature*; and *spirituality*. These cultural dimensions of well-being are not mutually exclusive and may reflect intertwined elements of human well-being.

Second, social and ecological outcomes of marine protected areas can be perceived differently by distinct stakeholder groups. While Litoral Norte managers tended to perceive conservation outcomes positively, fishers, fish vendors, maritime tourism operators, and scientists, generally had more negative perceptions. This mismatch of perceptions by different stakeholder groups about Litoral Norte is a concern for the future of this marine protected area. This is because negative perceptions of conservation outcomes are often associated with lack of support and disapproval of conservation initiatives by local stakeholders.

Third, articulating the perceptions of local users, marine protected area managers, and scientists into concrete conservation actions can not only increase overall support for marine protected areas, but also help improve both biodiversity and human well-being. Articulating perceptions into conservation actions requires participatory processes, which enable social learning, communication among stakeholders, and articulation of different worldviews, perspectives, knowledge types, values and aspirations. Including stakeholders' input into democratically deliberated conservation decisions can increase legitimacy, compliance, and responsibility of stakeholders towards the decisions made. This is because the "ownership" of decisions will be of the

involved stakeholders. Democratically deliberated conservation decisions involving diverse stakeholder groups are also better prepared to deal with the often-hard trade-offs between marine conservation and human well-being. A just and equitable distribution of costs and benefits inherent to those trade-offs contributes to more balanced decisions for biodiversity and people.

Participation of local stakeholders in conservation decisions is crucial for conservation success. This is an often-repeated message. And it is easier said than done. But efforts to improve communication and mutual understanding between marine protected area managers, fishers, fish vendors, maritime tourism operators, scientists, and other relevant stakeholders, can yield positive outcomes for conservation initiatives whose goal is to safeguard both biodiversity and human well-being.

Keywords: marine protected areas; MPA; conservation; Litoral Norte; Portugal; social-ecological systems; human well-being; ecosystem services; small-scale fisheries; tourism; perceptions; governance.

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Chapter 1

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1.
Setting the scene

Introduction

How would a flourishing world for people and nature look like?

Would it hold vast, wild, and pristine swaths of oceans, rivers and forests without human interference? Would it support thriving charismatic species where overexploitation of nature would be averted? Or would it be a world where whole ecosystems would be managed to support human requirements? Although portrayed in a simplified manner, these three questions represent nature conservation framings that have been guiding conservation practice and policy during the twentieth and twenty-first centuries. Yet it should be noted that these conservation framings reflect narratives of the Global North about the relationships between people and non-human nature. Other worldviews—especially traditional and indigenous—may not separate humans from nature (Gudynas, 2011), may be set upon inherently sustainable livelihoods (Trosper, 2002), and hence may not acknowledge that nature needs to be "conserved".

Mace (2014) has synthesised eloquently the three conservation framings that are dominant today. The oldest one—"nature for itself"—seeks to isolate and protect intact natural areas from human intervention, highlighting the intrinsic values of nature. The

creation of the Yellowstone National Park in 1872 possibly represents the first application of this highly influential conservation framing (Palomo et al., 2014). The rapid overexploitation and degradation of habitats in many world regions since the beginning of the Great Acceleration in the 1950s (Steffen et al., 2015) gave rise to the "nature despite people" framing in the 1970s. At the heart of this framing is the management of threats and negative impacts caused by humans on species and habitats (Mace, 2014). With the realisation in the 1990s that conservation strategies were generally failing—and that pressures on biodiversity were pervasive—a utilitarian view over nature started to emerge. The "nature for people" framing became mainstream with the publication of the Millennium Ecosystem Assessment in 2005 (MA, 2005). This framing focuses on the integrated management of ecosystems with the aim of providing goods and services to maximise human well-being. Its rationale revolves around the assumption that by showing our dependence on the benefits provided by healthy and functioning ecosystems, we are persuaded to safeguard nature. Yet an overly utilitarian view over nature can result in the expansion of the market logic to biodiversity conservation, creating incentives for economic self-interest above ethical and public concerns (Gómez-Baggethun et al., 2010). Besides, there is a growing recognition that we are not mere receivers of nature's benefits. What happens instead is a dynamic two-way relationship between non-human nature and us (Reyers et al., 2013; Comberti et al., 2015; Palomo et al., 2016).

Despite conservation efforts, the rate of biodiversity loss is unprecedented in human history (Ceballos et al., 2015). Today only 13% of the ocean can be classified as marine wilderness, and most of these wild areas are in the high seas (Jones et al., 2018). At least 30% of sharks, rays, and chimeras are threatened with extinction as well as 33% of reef-forming corals and 8% of bony fish (IUCN, 2019). About half of the live coral reef cover has disappeared since the 1870s (IPBES, 2019). Wetland loss could be as high as 87% since 1700, with much faster rates of loss in the twentieth and twenty-first centuries (Davidson, 2014). Overall, the average abundance of 16,704 populations of vertebrates representing 4,005 species of mammals, fish, amphibians,

reptiles, and birds, declined by 60% in the word between 1970 and 2014 (WWF, 2018). Insects are also threatened, as exemplified by the 76% decline of insect biomass over 27 years in 63 German protected areas (Hallmann et al., 2017). Biodiversity loss has been exacerbated since the 1950s when human activities—mostly from rich nations (Wiedmann et al., 2015)—started to interfere with Earth's life-support systems at the global scale (Steffen et al., 2015).

Biodiversity loss is not a mere ecological issue. It touches every aspect of our lives (Watson, 2019). Biodiversity provides us directly and indirectly food, medicines, genetic resources, energy and countless materials that are essential for our physical well-being (IPBES, 2018). Biodiversity is crucial for our cultures. It influences, inspires, and shapes identities, heritage, sense of place, art, religions, scientific advances, social relations and learning (Daniel et al., 2012; Garcia Rodrigues et al., 2017). We establish deep relationships with a myriad of life forms—these relationships are essential for our mental well-being and quality of life (Chan et al., 2016). Besides this utilitarian and relational perspective about biodiversity loss, loosing biodiversity is also an ethical issue because it disproportionately affects the poorest countries of the Global South (Fisher and Christopher, 2007). A crucial aspect about biodiversity is that its benefits are not fully substitutable, and many are irreplaceable (IPBES, 2019). This means that loosing biodiversity hinders human life in the long-term.

Conservation initiatives such as marine protected areas can be effective management tools to halt biodiversity loss, restore ecosystems, and create positive outcomes for our well-being (Edgar et al., 2014; Oldekop et al., 2016; Ban et al., 2019). Although conservation initiatives hardly tackle the drivers of biodiversity annihilation such as bloated consumerism and economic growth (Naidoo and Adamowicz, 2001), unregulated international trade (Lenzen et al., 2012), and economic inequality (Mikkelson et al., 2007), conservation initiatives do address pressures and threats to biodiversity. For example, conservation initiatives may alleviate pressures such as fishing, agriculture, mining or urbanization, by regulating or forbidding those activities inside protected areas. By addressing pressures, conservation initiatives indirectly tackle threats

caused by pressures, such as climate change, habitat loss and degradation, overexploitation and pollution. To halt biodiversity loss, conservation initiatives should be complemented with transformational sustainability interventions that deal with the root causes of unsustainability (Abson et al., 2017). Yet conservation initiatives need to be further investigated to improve their effectiveness in tackling pressures and threats to biodiversity, while negative social outcomes are minimised. In fact, the human dimension of protected areas such as the negative and positive impacts of protected areas on human well-being, is still a prevalent research gap of conservation science (Bennett et al., 2017).

A new conservation framing—"people and nature"—is emerging (Mace, 2014). This framing moves away from a focus on single species, habitats, or unidirectional streams of nature's benefits to people, to a non-linear, relational and pluralistic view of human and non-human nature relationships. It explicitly acknowledges that the separation of social from ecological systems is artificial and arbitrary because the two systems are intertwined and co-evolve together (Norgaard, 2006; Berkes et al., 2008). The "people and nature" framing suggests that protected areas are to be managed as social-ecological systems, which implies broadening the way we understand conservation by giving careful consideration to stakeholders' value systems, participation, and diverse knowledge sources (Palomo et al., 2014). This approach implies that hard choices of conservation decisions are transparently and democratically deliberated. To this end, the "people and nature" framing is useful for studying multiple-use protected areas whose goals are to safeguard biodiversity and human well-being.

Theoretical approach

This thesis is grounded on social-ecological systems theory. The core of social-ecological systems theory grew with contributions from both the natural and social sciences,

such as systems ecology, conservation biology, ecological economics, or political ecology. I believe this thesis follows the interdisciplinary tradition of social-ecological systems theory. Studying the human dimensions of conservation entails understanding people's perceptions, needs, and aspirations. It involves unveiling sources of social conflict and possible pathways of agreement in conservation initiatives. Importantly, a social-ecological systems approach acknowledges that people shape and are shaped by the surrounding environment and its ecological structures, processes and functions. Below, I elaborate briefly on the theory and concepts that underlie the theoretical approach of this thesis, with a focus on marine and coastal environments.

Marine social-ecological systems

We humans are deeply connected to the largest biome of the planet—the ocean. For thousands of years humans have lived in coastal communities where people fished, gleaned and hunted to support their livelihood (Erlandson and Rick, 2010). Living by the coast shapes cultures and identities whose actions influence the marine and coastal physical environments to which communities are connected to (Klain et al., 2014; Urquhart and Acott, 2014). Oceans are today crucial for trade and transportation and have an increasingly important role as a renewable energy source for us (Pelc and Fujita, 2002). There is also an immaterial side in the importance of the oceans for people because seascapes are known for triggering people's positive emotions and self-reported well-being (Wheeler et al., 2012; White et al., 2013). Oceans' importance is clearly reflected in the nearly 3 billion people who live within 100 km of the coast (Feist and Levin, 2016). In a globalised and interconnected world, our political, cultural and economic systems increasingly shape and are shaped by marine and coastal environments. In fact, the marine environment encompasses intertwined, interdependent, and co-evolutionary biophysical and human sub-systems that form together a coupled marine social-ecological system (Berkes, 2011).

Berkes et al. (2000) coined the term social-ecological system to highlight the interrelated nature of humans and ecosystems. Social-ecological systems are also referred to in the literature as human-environment systems, socio-environmental systems, or coupled human-natural systems (Leslie, 2017). Traditionally, ecological and social systems used to be studied separately. While biologists and ecologists focused on ecological processes and functions, anthropologists, geographers, economists and other social scientists centred their attention on human dynamics. Yet social-ecological interactions remained poorly understood as a result of the artificial separation of humans and nature in research. To address this issue, empirical interdisciplinary studies combining natural and social sciences are becoming increasingly common (e.g., Liu et al., 2007; Pollnac et al., 2010; Leslie et al., 2015). Empirical interdisciplinary research is helping to unveil important properties of social-ecological systems, namely their non-linear dynamics, feedback loops, heterogeneity, surprises, legacy effects, thresholds, and resilience (Liu et al., 2007). These properties emphasise the complex nature of social-ecological systems and provide important insights for conservation practice and policy such as the need to avoid panaceas and the search for integrative and place-based understanding of social-ecological systems (Ostrom and Cox, 2010; Leslie et al., 2015).

Marine protected areas are conservation initiatives that affect both ecosystems and people, and thus it is useful to consider them as interventions in complex social-ecological systems (Ban et al., 2017). This means that it is equally important to understand the stakeholder groups and governance system—with its formal and informal rules and institutions—, as is the ecological structures, functions and processes, and species occurring in the protected area. Good governance is particularly important for transparent, legitimate and accountable decisions. Perceptions of good governance by those affected by conservation leads to better compliance, acceptance, and increased support for local conservation initiatives (Leleu et al., 2012; Bennett et al., 2019). Good governance is often contingent on stakeholder engagement and deliberation in the designation, planning, and management of marine protected areas (Gleason et al.,

2010; Sayce et al., 2013). Stakeholder engagement in marine protected area creation and management is also a useful way to tackle the inherent uncertainty and unpredictability of marine social ecological systems (Gunderson and Holling, 2001). This is so because stakeholder participation can increase the range of available knowledge, lead to adaptive co-management, and contribute to social and institutional learning (Berkes, 2011). Stakeholder engagement is essential for governing complex marine social-ecological systems.

Marine protected areas

There are nearly 17,000 marine protected areas (MPAs) worldwide, as of 2019. These widespread marine management tools cover 8% of the world's oceans, comprising more than 28 million km2 of the ocean surface (UNEP-WCMC and IUCN, 2019). MPAs have usually a small size—3.3 km^2 (Boonzaier and Pauly, 2016)—but can reach up to 1,976,000 km^2, the size of Marae Moana MPA of the Cook Islands. Recent designations of large MPAs (> 10,000 km2)—mostly in the high seas—has moved us closer to achieving international biodiversity targets, such as the Aichi Target 11, which aims at effectively protecting 10% of the ocean by 2020.

According to the International Union for Conservation of Nature (IUCN), an MPA is "a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (IUCN - WCPA, 2008). MPAs range from strict nature reserves, intended only for biodiversity conservation or scientific research, to multiple-use areas, established to promote the sustainable use of ecosystem goods and services. There are also diverse MPA governance arrangements, ranging from co-management, community-based, to state-led MPAs (Mascia, 2004). The IUCN classifies MPAs into 6 categories that encompass different levels of protection, use, and purpose (**Table 1**).

Table 1. IUCN protected area management categories. Source: IUCN – WCPA (2008).

IUCN category		Main objective
IA	Strict Nature Reserve	Strictly protected areas to protect biodiversity and possibly geological / geomorphological features. Human visitation, use and impacts are strictly controlled and limited to ensure preservation of the conservation values. These areas can serve as indispensable reference areas for scientific research and monitoring.
IB	Wilderness Area	Large or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed to preserve their natural condition.
II	National Park	Large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, to provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities.
III	Natural Monument	Set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as caves or even a living feature such as an ancient grove. They are generally small protected areas and often have high visitor value.
IV	Habitat / Species Management Area	Protects particular species or habitats and management reflects this priority. Regular, active interventions often needed to address the requirements of particular species or to maintain habitats.
V	Protected Landscape / Seascape	Where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value; and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and values.
VI	Managed Resource Protected Area	Large, with much of the area in a natural condition and where a proportion is under sustainable natural resource management. Exploitation is a main aim of the area.

Well-enforced no-take MPAs can effectively protect marine biodiversity by increasing targeted species' biomass, abundance, and diversity compared to areas without protection (Edgar et al., 2014; Lester et al., 2009). While highly protected MPAs, that is IUCN categories I and II, can effectively protect marine biodiversity, less strict MPAs are known to be less effective (Ban et al., 2014). MPAs also contribute to human well-being: a recent review of 118 scientific papers found that half of the documented well-being outcomes were positive, while a third were negative (Ban et al., 2019). Because MPAs can provide both positive and negative outcomes for coastal communities,

MPAs long-term success often depends on the acceptance and support of local people (Pita et al., 2011; Voyer et al., 2015; Yates et al., 2019).

Ecosystem services

The term "ecosystem services" first appeared in 1981 (Ehrlich and Ehrlich, 1981) although it had been introduced before as 'nature's services' in 1977 (Westman, 1977). But it was only in 1997 that the ecosystem services concept started to receive mainstream attention. This was achieved with the publications of "Nature's services: societal dependence on natural ecosystems" (Daily, 1997), a book with theoretical and practical advancements of the concept, and "The value of the world's ecosystem services and natural capital" (Costanza et al., 1997), a scientific paper with value transfer estimates of the world's ecosystem services. The concept evolved over the last decades and ecosystem services can now be defined as "the ecological characteristics, functions, or processes that directly or indirectly contribute to human wellbeing: that is, the benefits that people derive from functioning ecosystems" (Costanza et al., 2017). These benefits to human well-being are complex, non-linear and dynamic, and are usually co-produced with human capital inputs and influenced by governance systems (Reyers et al., 2013; Primmer et al., 2015; Palomo et al., 2016). The ecosystem services concept emerged from a growing need to recognise the importance of ecosystems in public policy. This need became increasingly clear with the rapid depletion of nature since mid-twentieth century and the resulting negative impacts on human well-being (Costanza et al., 2017). With the contributions of the ecosystem ecology community and the environmental resource economics community—and with the emergence of ecological economics (Røpke, 2004)—, the ecosystem services concept started gaining theoretical roots and eventually became widespread in environmental sciences and economics (Droste et al., 2018). While scientific knowledge about ecosystem services greatly improved in the last decades, its practical application remains limited in policy and decisions (Guerry et al., 2015).

Several classification systems exist for ecosystem services to enable theoretical developments and assessments (e.g., MA, 2005; TEEB, 2010; Haines-Young and Potschin, 2013), including specific classifications for the marine and coastal environment (Beaumont et al., 2007; Liquete et al., 2013). Recently, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) claimed to have expanded the notion of ecosystem services by recognising the central role of culture in human-nature interactions, as well as indigenous and local knowledge and related worldviews (Díaz et al., 2015). Eventually the IPBES nomenclature for ecosystem services changed to "nature's contributions to people" (Díaz et al., 2018) triggering critique (Maes et al., 2018) but also perspectives welcoming pluralism (Peterson et al., 2018). While classification systems and nomenclatures of ecosystem services were created for slightly different purposes, they all share similar overall categories: supporting, regulating, provisioning, and cultural ecosystem services (Costanza et al., 2017). Supporting ecosystem services are the underlying ecological processes and functions, such as primary production, habitats and photosynthesis, that support the supply of all other ecosystem services. Regulating ecosystem services such as coastal protection, climate regulation and ocean nourishment, represent the ways ecosystems and organisms affect the environment resulting in a direct or indirect enhancement of human well-being. The material contributions of ecosystems are usually associated with provisioning ecosystem services such as fish, seaweed or medicinal compounds. Cultural ecosystem services—the category that receives the biggest focus on this thesis—represent the interactions between environmental spaces, such as oceans, beaches and seascapes, and cultural practices, such as playing, creating and caring (Fish et al., 2016). Cultural interactions with nature give rise to benefits for people in the form of experiences (e.g., connection to nature, aesthetics), identities (e.g., place identity, spirituality), and capabilities (e.g., knowledge about nature, health). Overall, there is a growing recognition in ecosystem services research that humans shape and are shaped by ecosystem services.

What are the advantages and drawbacks of applying the ecosystem services concept in biodiversity conservation practice and policy? To begin with, biodiversity conservation needs a broad social support to be successful in providing positive social and ecological outcomes (Bennett, 2016; Bennett et al., 2019). For that to happen conservation values and norms need to extend beyond environmentalist and conservationist movements and reach the wider public. In other words, conservation needs to be widespread across society, and that requires broad changes of social norms (Chan et al., 2017). While normalising conservation have hardly resulted from ecosystem services research and practice, the ecosystem services concept offers great potential in the creation of norms for conservation through justice, equity, and value formation (Jax et al., 2013; Chan et al., 2017).

The ecosystem service concept can help unveil justice and equity issues of conservation because the access and distribution of ecosystem services benefits can be unevenly distributed due to power asymmetries (Felipe-Lucia et al., 2015; Berbés-Blázquez et al., 2016). Explicitly incorporating issues of access and power in ecosystem service assessments of conservation initiatives can help strengthen the legitimacy of conservation planning and management. People's perception of legitimate conservation can enable norm change due to related perceptions of just and equitable outcomes. Moreover, the powerful message that ecosystem services can enhance people's lives can create a widespread sense of responsibility that prevent people from damaging the sources of people's well-being, that is ecosystems (Chan et al., 2017). The contribution of the ecosystem services concept to value formation can be recognised with a careful assessment of cultural ecosystem service and their values in conservation initiatives. Cultural ecosystem services and their associated relational values (Chan et al., 2016) are often place-based, allowing our experiences, capabilities and identities to be enhanced and developed by interacting with specific natural places. Our identities, experiences and capabilities strongly shape our values and norms (Stern et al., 1999; Stets and Biga, 2003). In this sense, reconnecting with the biosphere by visiting, exploring and relating to protected areas—many of which promote environmental

education, recreation and nature tourism—can help broaden social support for conservation initiatives and norm enforcement.

The main critiques of applying the ecosystem services concept in biodiversity conservation stem from its anthropocentric, instrumental, and monetary valuation focus (Schröter et al., 2014). Critics argue that these characteristics of the ecosystem services concept encourage the unsustainable exploitation of ecosystems, conflict with biodiversity conservation aims, and promote the commodification of nature (Norgaard, 2010; Gómez-Baggethun and Ruiz-Pérez, 2011; Raymond et al., 2013). While neoliberal conservation projects using the ecosystem services concept may promote a pecuniary focus, incentivise private over public interest, and oversimplify what are complex social-ecological dynamics (Büscher et al., 2012; Arsel and Büscher, 2012; Corbera, 2012), the ecosystem services concept extends much beyond that narrow focus. Ecosystem services assessments can include participatory multi-criteria decisions that empower local stakeholders and increase the legitimacy of conservation initiatives (Langemeyer et al., 2018). Assessments of ecosystem services can be inclusive by embracing plural values of biodiversity such as intrinsic, instrumental and relational values (Arias-Arévalo et al., 2018). They can also address the inherent complexity of social-ecological systems by including cross-scale interactions that affect ecosystem services access and management (Martín-López et al., 2019). At the end, it is not the ecosystem services concept itself that will determine positive or negative conservation outcomes. But the choice between a simplistic focus on the monetary values of biodiversity and linear stock-flow processes, or a much broader and integrative focus on the relational, intrinsic, and instrumental values of ecosystems, their complex dynamics, and democratic and inclusive deliberation of ecosystem services trade-offs.

Human well-being

The human well-being concept is increasingly important in conservation science, practice and policy (McShane et al., 2011; Bennett et al., 2017; Naidoo et al., 2019),

including in the marine context (Mascia et al., 2010; Ban et al., 2019). This stems in part from an increasing adoption of a social-ecological systems perspective in conservation (Berkes, 2011; Ban et al., 2013) where social and ecological elements are conceptualised in an integrative way (Berkes et al., 2000). The "people and nature" conservation framing revolves around this notion and envisages a complex and multidimensional two-way relationship between human well-being and non-human nature (Mace, 2014). The importance of the human well-being concept in conservation is also associated with the growing importance of the ecosystem services concept in environmental practice and policy (MA, 2005; Díaz et al., 2015). Assessing ecosystem services helps unveiling the links between the status of ecosystems and human well-being (Bonet-García et al., 2015), although this is often a non-linear relationship (Raudsepp-Hearne et al., 2010; Daw et al., 2016).

Human well-being can be defined as "a state of being with others and the environment, which arises when human needs are met, when individuals and communities can act meaningfully to pursue their goals, and when individuals and communities enjoy a satisfactory quality of life" (Breslow et al., 2016). This definition evokes conceptualisations on human needs (Max-Neef et al., 1990) and an eudaimonic conception of human well-being (Ryan and Deci, 2001). Besides this definition, the authors propose a relevant conceptualisation of human well-being for conservation. (Breslow et al., 2016) organise a nested framework of domains, attributes and indicators that depart from four major constituents of well-being: conditions, capabilities, connections, and cross-cutting domains. Conditions include tangible qualities of the environment, economy, safety, or health, and are related with basic human needs. Capabilities encompass livelihoods, freedom, knowledge, or governance domains that entail living a meaningful life (eudaimonic conception of well-being). Connections encompass relationships with other and with nature and related cultural practices and identities. The cross-cutting constituent include equity and justice domains, security, resilience, and sustainability. This conceptualisation of human well-being assumes that people

shape and are shaped by ecosystems and emphasise the importance of healthy and functioning ecosystems for humans to thrive.

Aim and research questions

How can multiple-use MPAs better account for human well-being? This is the guiding question that structures this thesis (**Figure 1**). Without contesting the primary goal of protected areas—to protect and conserve biodiversity—, I explore how people depend, relate to, perceive, and envisage Litoral Norte, a multiple-use MPA located in northern Portugal. I believe this a topic worth exploring because the number and extent of MPAs is growing worldwide. Moreover, the designation of MPAs is often promoted by states or non-governmental organisations as a strategy to safeguard both marine biodiversity and coastal livelihoods. Yet, while positive effects of MPAs on biodiversity are well-know, research on how MPAs impact human well-being is still incipient. Particularly MPA effects on social, health, and cultural dimensions of well-being. To this end, this thesis revolves around four interrelated research questions:

1. How does Litoral Norte MPA support the subjective well-being of nearby residents and visitors? **(chapter 2)**;

2. How do local stakeholders perceive Litoral Norte MPA governance and management, especially those whose livelihoods depend on local marine and coastal resources? **(chapter 3)**;

3. What are local stakeholders' aspirations and positive future visions for Litoral Norte MPA, and how could they attain those envisioned positive futures? **(chapter 4)**;

4. What lessons can be learned for conservation practice and policy from the case study of Litoral Norte MPA? **(chapters 2, 3,** and **4)**.

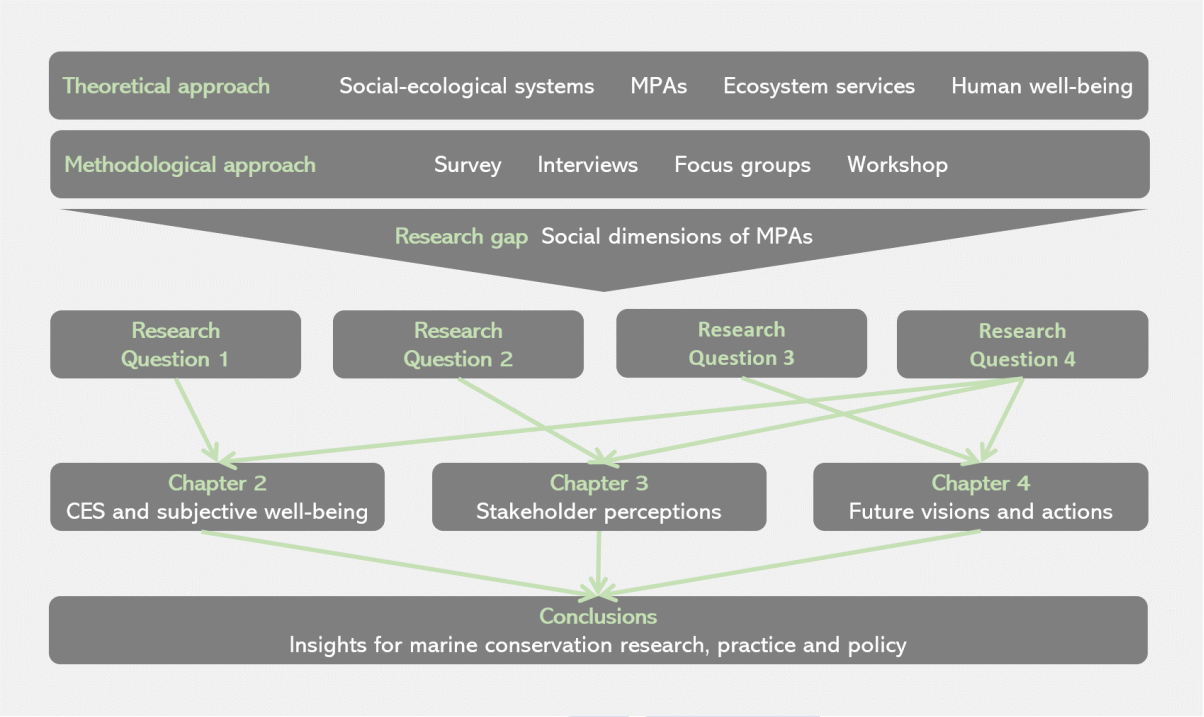

Figure 1. Structure of the thesis. Figure shows connections between the theoretical and methodological approach that ground the thesis, and the research gap that originates research questions whose tentative answers are provided in the following chapters. At the end, conclusions summarise the main findings and insights derived from the thesis.

Study area: Litoral Norte Nature Park

I have chosen Litoral Norte Nature Park as a case study for this thesis because I believe it represents a useful case to answer the research questions of this thesis. Litoral Norte encompasses a complex and dynamic marine social-ecological system. The park is an IUCN category V multiple-use protected area (**Table 1**) located inside the municipality of Esposende in northern Portugal (**Figure 2**). It covers an area of 8887 ha of which

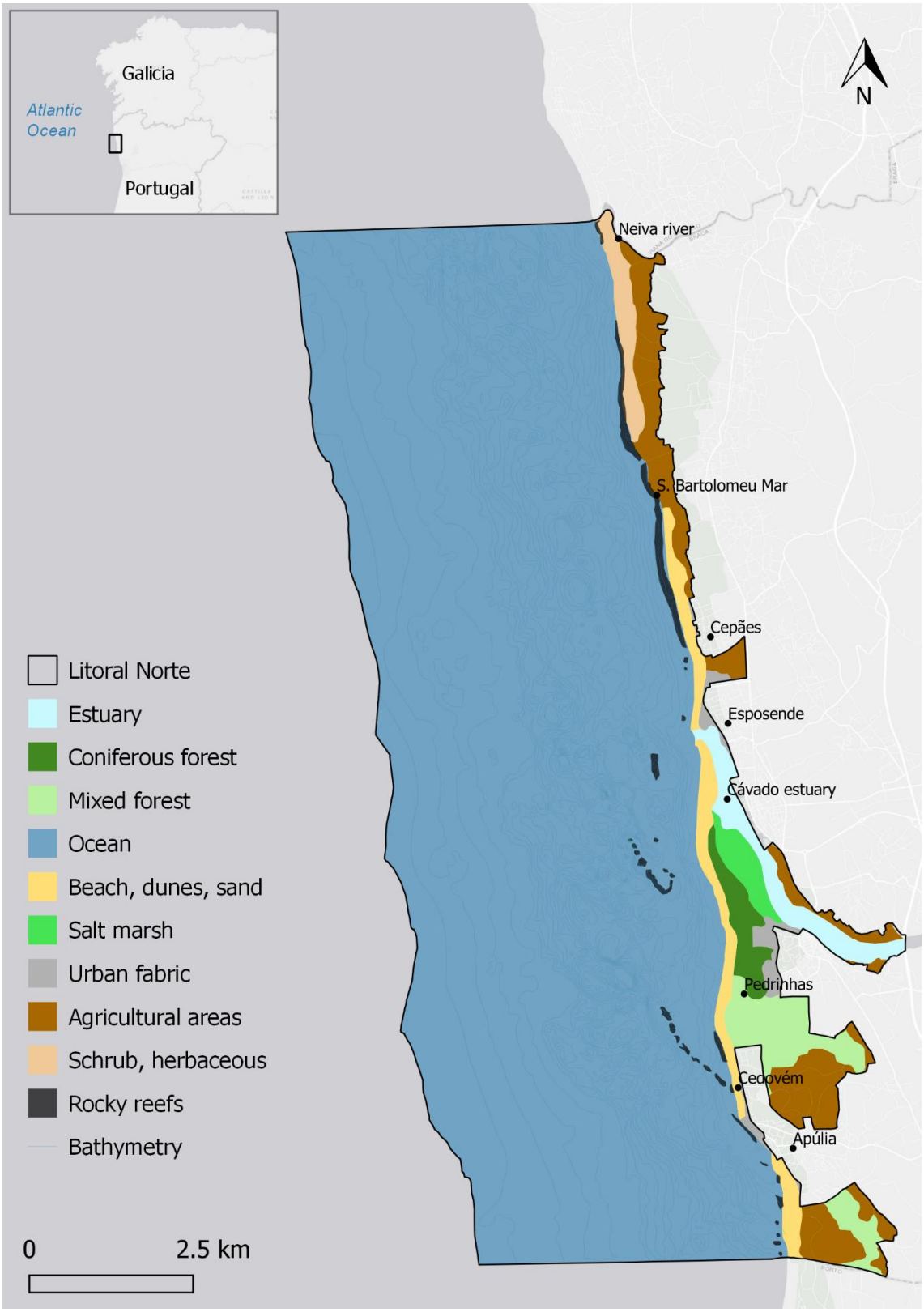

Figure 2. Location of Litoral Norte Nature Park. Map shows main land-use types in the coastal fringe of the MPA.

14% are terrestrial and 86% marine. Litoral Norte was first designated in 1987 as a protected landscape mainly to safeguard the local dune system from increasing urban

pressure. As a result, in 1987 the protected landscape of Litoral Norte included only the coastal fringe from the Cávado river in the south up to the Neiva river in the north. In 2005, the area of Litoral Norte expanded east and westwards as a result of a change of its legal status to nature park, status that still holds today. As Litoral Norte is essentially marine (86% of the total area)—and indeed the marine area as the legal status of "marine park" (Regulatory decree, 2005)—I refer to it as Litoral Norte marine protected area (MPA) throughout the thesis.

The social-ecological system of Litoral Norte

Litoral Norte MPA protects a rich diversity of habitats and species. In its marine area we can find rocky reefs, kelp forests, biogenic reefs, and sandy areas. There are saltmarshes, reed beds, and mudflats in the two estuaries of the Cávado and Neiva rivers. The coastal fringe has a complex and dynamic dune system with humid dune slacks that harbour a rich variety of species. Broadleaf, mixed and pine forests grow in the terrestrial area of the park. There are priority conservation species of mammals, amphibians, reptiles, birds, and plants. Marine species with conservation priority include the European eel (*Anguilla anguilla*), white seabream (*Diplodus sargus*), European conger (*Conger conger*), sea lamprey (*Petromyzon marinus*), and the European seabass (*Dicentrarchus labrax*). As of 2019, the Marine Observatory of Esposende (OMARE, 2019) had identified 108 different habitats and 2366 species only in the marine area of the park. Sightings of new species are added regularly.

Ecosystems of Litoral Norte support the livelihoods of local coastal communities. Two fishing communities—Apúlia and Esposende—rely on the MPA's fishery resources. These fishing community households have a clear gendered division of labour in which men go out fishing, whereas women run fish sale business. The MPA is also important for gleaners who harvest sea urchins, octopus, gooseneck barnacles, limpets, mussels, and other marine organisms in intertidal zones.

Beaches, estuaries and seascapes of the MPA are attractions for national and international tourists. Since decades ago, beach tourism has been one of the most important sources of revenue for the local economy. Owners of housing and hotel companies, restaurants, bars and shops profit from seasonal revenues brought by tourists. Adding to beach tourism, the importance of nautical sports has been growing. The Cávado estuary and other coastal areas of Litoral Norte have been increasingly sought after by locals and tourists for surf, kitesurf, kayaking and diving. Hiking and bird watching are also increasingly popular, thus contributing to the growing importance of nature tourism in the MPA.

There are rich social and cultural elements in Litoral Norte MPA. The area is embedded in a complex social-ecological system in which humans have been living for millennia. There are archaeological sites from the Copper Age (Calcolithic) and salt pans from the Roman or post-Roman ages in its intertidal zones. Moreover, shipwreck sites are common, including cargos of Roman vessels, ships from the XVI century, and war planes that fought in the Second World War.

The maritime character of the region has undoubtedly shaped local cultural heritage and identity. There are diverse cultural practices and festivities associated with the sea. One of the most iconic cultural practices pertains to the *Sargaceiros* who developed unique costumes and dances associated with the secular practice of harvesting sargassum seaweeds to fertilize agricultural fields. Those fields—called *masseiras*—are by themselves unique and peculiar elements of local heritage. Masseiras are coastal agricultural grounds excavated several meters below the surface to get crops closer to groundwater and hence improve agricultural yields.

An important festivity in the region is the *Romaria de S. Bartolomeu do Mar*, which occurs in a small coastal village located in the outskirts of the park. Every 24th of August thousands of people dive into the waves of the sea for what is called the “holy bath”. The procession of the sea is another cultural expression associated with the ocean. Annually, local fishers take out their boats onto the water where they place a

wreath of flowers in memory of those fishers lost at sea. Local festivities, processions and rituals have a strong maritime character.

Governance and management of Litoral Norte

Litoral Norte was designated as "Nature Park" in 2005 by the Portuguese government (Regulatory decree, 2005). There are two governance institutions of Litoral Norte: a steering committee—with executive power—and an advisory council. The steering committee is presided by a representative of the Institute of Nature Conservation—the institution that manages Litoral Norte. The advisory council includes representatives of the local municipality, non-governmental organisations, research institutes, local associations, and other civil organisations that advise the steering committee. Yet, recent attempts by the Portuguese government (XXI Constitutional Government) to decentralise state competencies has opened the possibility of protected areas to be governed differently in the future. The Portuguese government has proposed that protected areas are governed jointly by municipalities, representatives of civil society such as non-governmental organisations, and the Institute for Nature Conservation (Statement Council Ministers, 2018). The government proposes that this governance body is presided by municipalities. As of 2019, this governance arrangement is still under deliberation by the Portuguese Parliament and the future governance of protected areas in the country is still uncertain.

The Portuguese government (XVIII Constitutional Government) has set several general objectives for Litoral Norte. Objectives include not only conserving biodiversity, geodiversity and landscape/seascape heritage, but also ensuring a sustainable use of natural resources and recovering depleted or overexploited resources. Scientific studies in the area and environmental education are to be promoted. As are economic activities: (mainly) tourism and recreation that need to be compatible with local ecological, aesthetic and cultural values. Another goal of Litoral Norte is to promote sustainable development and the well-being of local populations.

Litoral Norte has a spatial plan with different levels of protection (Resolution of the Council of Ministers, 2008). Each level of protection determines the human activities that are allowed or forbidden to occur inside each zone. Levels of protection range from zones of partial protection type I—the highest level of protection in Litoral Norte—, to zones of complementary protection type I and II, which are mainly buffer zones that separate the inside of the park from the outside. For example, in the marine area there are several zones of partial protection type I. Zones of partial protection type I intend to safeguard areas with high biodiversity value. Yet they still allow human activities to occur, but these activities need to be compatible with the objectives of biodiversity conservation. In fact, commercial fisheries are allowed in the whole area of the marine park. Commercial fisheries can only be small-scale and explored by local fishing communities. Although these fisheries are regulated by state law, park managers have regulatory and executive powers to suspend fishing inside the marine park every time fishing practices are not compatible with the park's conservation objectives. Zones of partial protection type I are mostly associated with biodiversity-rich rocky reefs in the marine and intertidal zones and nursery areas of the Cávado estuary.

Methodological approach

I follow an inter and transdisciplinary methodological approach in this thesis. Interdisciplinary in the sense that I integrate theories, concepts, perspectives and techniques from different disciplines. For example, I ground this study in social-ecological systems theory and use the ecosystem services concept as a metaphor of human-environment interactions. Moreover, I apply qualitative and quantitative methods to collect and analyse data for this thesis. It is also a transdisciplinary methodological approach because part of the thesis' outcomes results from a process of collaboration between scholars and non-scholars. The outcomes of the workshop **(chapter 4)**

organised under this thesis are a good example of such a collaborative process between scholars and non-scholars, involving fishers, maritime tourism operators, scientists and conservation practitioners. Combining inter and transdisciplinary approaches offers a wide array of theoretical and practical tools to answer research questions at the interface of social and ecological systems, as is the case of the researched questions asked in this thesis.

For analytical reasons I purposefully differentiate social groups along this thesis. I distinguish those groups whose livelihoods depend on what Litoral Norte MPA provides, those who manage the MPA, those who do research in the area, and those who visit it mainly for cultural and recreational purposes. Social groups who depend on Litoral Norte for a living include fishers, fish vendors, and maritime tourism operators. Managers involve those who have a stake in the decisions that regulate the MPA and thus include representatives of the local municipality and of the national institute of nature conservation. Nearby residents—whose livelihoods do not depend directly on Litoral Norte MPA—and visitors are the groups who visit the area mainly for cultural and recreational purposes. I am aware this may entail an artificial division of social groups since people may play different roles at the same time or change roles over time. Yet I believe this division brings clarity and structure to data collection and analysis.

I have used different data collection methods along this thesis. These included a survey of nearby residents and visitors of Litoral Norte MPA to understand how the MPA supports subjective (that is, self-reported) well-being **(chapter 2)**. Data collection also encompassed qualitative methods. I designed and conducted semi-structured interviews and focus group discussions with fishers, fish vendors, maritime tourism operators, MPA managers, and scientists to explore their perceptions about Litoral Norte MPA governance and management **(chapter 3)**. Moreover, participatory methods had also their place this thesis. We have organised a workshop with local people who either use, manage, or do research on the MPA **(chapter 4)**. Workshop exercises allowed me to collect data on peoples' positive future visions of Litoral Norte MPA.

Data collected with these methods ranged from quantitative data, mainly from a survey, to qualitative data from interviews, focus groups and workshop exercises.

I have applied several data analysis methods according to the needs posed by the research questions and available data. To analyse survey data, I did principal component analysis, exploratory factor analysis and interpreted descriptive statistics **(chapter 2)**. Qualitative data from semi-structured interviews and focus group discussions required a different approach. To make sense of these data, I coded text transcripts using a thematic analysis approach, followed by a network analysis of the coded themes **(chapter 3)**. The workshop generated mainly qualitative data. For that, I did narrative analysis, digitised participatory map data, and described participants' perceptions about ecosystem service trends of Litoral Norte MPA **(chapter 4)**. In summary, I have used a mixed-methods approach in this thesis in the sense that I analysed qualitative and quantitative data that were collected through a diverse set of methodologies.

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Chapter 2

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2.
Assessing subjective well-being provided by cultural ecosystem services of Litoral Norte MPA

Introduction

Marine protected areas (MPAs) can be effective management tools to achieve ecological (Lester et al., 2009; Edgar et al., 2014) and socio-economic goals (Mascia et al., 2010). MPAs can also encompass areas with high cultural significance for society in the form of identities, meanings, and values (Poe et al., 2014; Jobstvogt et al., 2014). That is why MPA governance and management can affect people's cultural practices in MPA sites by affecting people's connections to place and nature. These connections lay the foundations of central cultural elements of human well-being (Breslow et al., 2016). Yet, while ecological, economic and governance dimensions of well-being have received considerable attention in marine conservation research, cultural dimensions are much less studied (Ban et al., 2019). Failing to think about the cultural dimensions of well-being in biodiversity conservation risks creating and exacerbating social inequality and power asymmetries (Holmes and Cavanagh, 2016), conflicts and lack of trust (Outeiro et al., 2019). Including cultural considerations in conservation

interventions may enhance support by local communities by reducing conflict and reaching fairer conservation decisions (Evans and Klinger, 2008).

Multiple-use MPAs contribute to human well-being in complex and numerous ways. Besides their material contributions such as seafood, seaweeds, or renewable energy, they often encompass important sites for people's immaterial connections to nature (Potts et al., 2014). These connections arise through interactions between environmental spaces and cultural practices, which are conceptualised as cultural ecosystem services (Fish et al., 2016). Spaces of marine and coastal environments may include beaches, seascapes or coastal waters, while cultural practices may comprise playing, gathering or caring. Cultural ecosystem services lay the foundations of the cultural dimensions of human well-being associated with the interactions between people and non-human nature (Russell et al., 2013). Yet research on ecosystem services has been missing assessments of subjective and intangible cultural ecosystem services, resulting in a limited understanding of the relationships between cultural ecosystem services and human well-being, especially in the marine and coastal environment (Garcia Rodrigues et al., 2017).

Cultural dimensions of human well-being related to nature are supported by what can be conceptualised as cultural ecosystem benefits such as identities, experiences and capabilities (Fish et al., 2016). Interacting with nature contributes to developing people's identities through sense of place (Ainsworth et al., 2019), connectedness (Mayer et al., 2009) and spirituality (Heintzman, 2009). Being in nature enables experiences through aesthetic appreciation (Fletcher et al., 2014), inspiration (Oliveira and Berkes, 2014) and opportunities for solitude (Borrie and Roggenbuck, 2001). It can also enhance capabilities such as knowledge about nature (Plieninger et al., 2013), cognitive functioning (Berman et al., 2008), and physical and mental health (Hartig et al., 2014). While there is ample evidence that interactions between people and nature positively affects constituents of well-being (Ban et al., 2019), only a few studies have systematically integrated multiple elements of well-being in ecosystem services assessments (Bryce et al., 2016).

Assessing subjective well-being—a self-reported assessment of a person's overall well-being—can shed light on the motivations that lead people to interact and value non-human nature. For example, recreational sea anglers and divers seek a wide variety of UK marine sites due to perceived values associated with engagement with nature, place identity, and health (Bryce et al., 2016). MPA stakeholders might value the protected areas as places of care, spirituality, freedom, and refuge (Pike et al., 2015). Coastal residents derive aesthetic pleasure, sense of place, and cultural identity as elements of a "fulfilled human life" associated with living by the coast and relating to charismatic marine life and biodiversity (Ainsworth et al., 2019). Examining relationships between people and the marine environment reveals limitations in the 'instrumental vs. intrinsic values' dichotomy that has been guiding environmental ethics and biodiversity conservation (Muraca, 2011). People are not limited to choices and behaviour guided solely by the inherent worth (intrinsic value) or utility of nature (instrumental value). But also by how they relate with nature—emphasising the relevance of relational values (Himes and Muraca, 2018). Relational values encompass a wide range of values about nature such as identity, care, stewardship or reciprocity (Chan et al., 2016). This relational notion of well-being reflects an eudaimonic approach to life—a good, meaningful, and worthwhile life—that can be explored to understand what fosters subjective well-being (Ryan and Deci, 2001).

In this chapter, I aim to explore the role of Litoral Norte MPA—a multiple-use MPA—in supporting cultural dimensions of subjective well-being. To this end I ask the following research questions:

- What cultural dimensions of subjective well-being underlie the immaterial connections between people and Litoral Norte MPA sites?
- How do people's socio-economic characteristics and environmental behaviour affect cultural dimensions of subjective well-being?
- What insights of subjective well-being assessments can be drawn for MPA practice and policy?

Methods

Data collection

We did 453 face-to-face structured interviews between October and December of 2018 in Esposende—the Portuguese municipality where Litoral Norte MPA is located ("study area", chapter 1). We used two sampling strategies: one for residents of the municipality, and other for non-residents (hereafter, visitors). Since we knew the number and distribution of residents in the municipality (INE, 2018), we applied a stratified random sampling per municipality parish (351 interviews, 95% confidence interval, ± 5% margin of error). For visitors we only had estimates about the annual number of MPA visits. That is why we decided to apply a convenience random sampling in places known to be frequently visited by non-residents (102 interviews, 95% confidence interval, ± 10% margin error). In both sampling groups we chose to interview people over 18 years old. We pre-tested interview questions prior to survey implementation to assess the suitability of the survey design.

To measure the cultural dimensions of well-being supported by Litoral Norte MPA we asked survey respondents to report their degree of agreement with a set of indicator statements (**Table 2**). Survey respondents had to choose an option from a 5-point Likert scale for each indicator statement. The Likert scale ranged from "strongly disagree" to "strongly agree". Indicator statements were intended to represent well-being constructs relevant for recreational users of the marine environment. These constructs reflect an eudaimonic conception of well-being (Ryan and Deci, 2001). Constructs were selected based on human well-being frameworks (Max-Neef et al., 1990; Cruz et al., 2009) and on previous studies about the relationship between people and nature (Fuller et al., 2007; Chan et al., 2012a, 2012b; Tengberg et al., 2012; Dallimer et al., 2012). To measure subjective well-being we relied on the same 15 indicator statements used by (Bryce et al., 2016) plus one indicator statement reflecting "solitude". Positive experiences of solitude in nature suggest that being alone in nature

contributes to peace, tranquillity, self-reflection and sense of freedom. (Borrie and Roggenbuck, 2001; Long and Averill, 2003; Heintzman, 2009).

Table 2. Indicator statements used in the survey to assess cultural ecosystem benefits to human well-being provided by sites of Litoral Norte MPA. Adapted from Bryce et al. (2016).

Indicator statement	Theoretical constructs
Visiting this site clears my head.	Reflection and sense of wholeness
I gain perspective on life during my visits to this site.	Reflection and sense of wholeness
Visiting this site makes me feel more connected to nature.	Reflection and sense of wholeness; connection to nature
At this site I feel part of something that is greater than myself.	Reflection and sense of wholeness; spiritual value
This site feels almost like a part of me.	Place identity and continuity with the past
I feel a sense of belonging in this site.	Place identity and continuity with the past
I've had a lot of memorable experiences in this site.	Place identity and continuity with the past; transformative values
I miss this site when I have been away from it for a long time.	Place identity and continuity with the past
Visiting this site has made me learn more about nature.	Knowledge about nature
I have made or strengthened bonds with others through visiting this site.	Social bonds
I feel like I can contribute to taking care of this site.	Participation
I have felt touched by the beauty of this site.	Aesthetics
This site inspires me.	Inspiration
Visiting this site leaves me feeling healthier.	Health
Visiting this site gives me a sense of freedom.	Freedom
I can be alone and appreciate solitude when I visit this site.	Solitude value

The survey was structured in five sections (**Table S2.1 supp info**). In the first section we asked participants about recreational activities and behaviour in Litoral Norte MPA. The following section included questions about the contribution of MPA sites to human well-being. Here we included the 16 indicator statements to measure self-reported well-being. For this, we asked participants to identify one MPA site they knew and considered important, unique or special. Indicator statements were contingent to the chosen MPA site. To avoid potential response order effects (Krosnick, 1999), we

used two survey versions that differed only in the ordering of the indicator statements. The third section of the survey comprised questions about knowledge and opinions about Litoral Norte MPA. We asked questions about environmental behaviour in the fourth section. In the last section we collected participants' socio-economic characteristics. Throughout the interviews we never mentioned the term 'ecosystem services' to avoid imposing a potential cognitive burden on the respondents, as the term could be not known. Instead, questions about ecosystem services were framed around the well-being benefits that people derive from marine and coastal sites, the relationships that people have with those sites, and the importance of marine and coastal sites in people's lives.

Data analysis

The data analysis process entailed three stages. First, I did a categorical principal component analysis (PCA) to transform the raw data of the survey. Second, after transforming the data, I did an exploratory factor analysis (EFA) (Mair, 2018) to reveal latent constructs reflected by the indicator statements used to assess well-being. Third, I ran statistical tests to compare the effect of respondent's environmental behaviour, opinions and socio-economic characteristics in the EFA latent construct scores. I did all data analysis procedures in the R version 3.5.1 (R Core Team, 2018).

To be able to run the EFA I first transformed the raw data through "optimal transformation" by doing a categorical PCA (Linting et al., 2007). I applied this data transformation because data were ordinal (5-point Likert scale), non-normally distributed (positively skewed), and susceptible to strong effects of outliers in the computation of correlations and covariances. I used the function "princals" of the R package "Gifi" (Mair and Leeuw, 2019) to run the categorical PCA (**Table S2.2 supp info**). Then I analysed categorical PCA models with a varying number of components and chose the model that best fitted the data, based on the Kaiser-criterion (eigenvalues > 1) and scree plot inspection (**Figure S2.3 supp info**) (Kaiser, 1960; Mair, 2018). I

selected the first three components of the categorical PCA and then computed the optimally transformed scores, which I used to run the EFA.

I did an EFA since the latent constructs of the 16 indicator statements used to assess well-being provided by marine cultural ecosystem services are not yet theoretically established (Bryce et al., 2016). Factor analysis can reveal the underlying structure of the indicator statement data without imposing a priori conceptions of well-being. That is why I used factor analysis—to identify interpretable dimensions of self-reported well-being associated with the marine environment. To run the EFA I used the function "fa" of the R package "psych" (Revelle, 2018). My protocol for EFA consisted of using "maximum likelihood" as a factor extracting method, and to rotate the matrix of factor loadings with a "varimax" rotation to obtain orthogonal factors.

After identifying the factor structure describing interviewees' self-reported well-being I tested whether the composite factor scores varied significantly according to socio-economic characteristics, reported environmental behaviour, and knowledge and opinions about Litoral Norte MPA. I computed the composite scores for each factor that emerged from the EFA. Composite scores were based on the mean values of the indicator statements that loaded onto each factor. To analyse differences between two-group data I applied Wilcoxon rank-sum tests (Wilcoxon, 1945; Mann and Whitney, 1947). For three- or more group data I used Kruskall-Wallis tests (Kruskal and Wallis, 1952), followed by post-hoc Dunn tests for inter-group comparisons (Dunn, 1964). For the Dunn tests I adjusted the p-values with the Benjamini-Hochberg method (Benjamini and Hochberg, 1995). I did the statistical tests with the functions "wilcox.test", "kruskal.test", and "dunnTest" of the R package "FSA" (Ogle et al., 2019). All survey variables and statistical tests are shown in the supporting information at the end of this chapter (**Figure S2.4 supp info**).

Results

Survey sample

We interviewed a total of 453 people, lasting each interview 23 minutes on average. After removing incomplete interviews, we ended up with 367 valid interviews (**Table S2.5 supp info**). Of those 367 surveyed people, 48.8% were female and 51.2% male. All interviewees were adults with ages ranging from 19 to 91 years and a mean age of 43. Most interviewees (32.4%) had high school education, followed by those with a university degree (25.3), middle school (21.5%), and those who only attended elementary school (3.8%). About three quarters (75.2%) were residents of Esposende—the municipality where Litoral Norte MPA is located—, and nearly one quarter (24.8%) were Portuguese visitors. The mean time living in the municipality of surveyed Esposende residents was 30 years. Most interviewees (62.4%) identified the setting where they lived as urban, while the remainder (37.6%) reported living in a rural environment. On average, households were composed of 2.9 people. Although 25.6% of interviewees did not disclose their monthly household income, about half (51.5%) reported having less than 1700 euros of available household income per month. Most of interviewees (76.0%) were employed.

Although Litoral Norte MPA was designated in 2008, 35.1% of interviewees were not aware of the protected area. Among those who did not know the MPA, 69.8% were residents of the municipality of Esposende, and 30.2% were visitors. When asked about their agreement with the existence of the protected area in the municipality, most residents (71.4%) believed the MPA should exist. A similar proportion of visitors (69.2%) were of the same opinion. Although the proportion of interviewees who were against the existence of the protected was low (5.1% of residents and 2.3% of visitors), 23.6% of residents and 28.6% of visitors did not have an opinion at the time of the interview.

Cultural dimensions of subjective well-being

All 16 indicator statements (hereafter, items) representing cultural ecosystem benefits to well-being had positive responses, suggesting that interviewees experienced the variety of benefits asked in the interview (**Table S2.4 supp info**). Four factors emerged from the EFA, cumulatively explaining 82% of the variance of survey data (**Table 3**). All 16 items of cultural ecosystem benefits loaded strongly (factor loadings > 0.45) onto four interpretable cultural dimensions of subjective well-being related with marine and coastal sites. I interpreted and labelled the factors consistently with well-being constructs described in the scientific literature.

Table 3. Factor loadings along four interpretable cultural dimensions of human well-being. The four dimensions of cultural ecosystem benefits are engagement with nature & health, sense of place, solitude in nature, and spirituality. Factors were extracted from optimally transformed (categorical PCA scores) survey data with maximum likelihood with varimax rotation. Grey shading indicates strong loading (> 0.45) of a cultural ecosystem benefit on a specific factor.

Abbreviated indicator statements	Engagement with nature & health	Sense of place	Solitude in nature	Spirituality
To feel healthier	0.95	0.19	0.22	0.13
To have an aesthetic experience	0.95	0.19	0.22	0.13
To feel inspired	0.95	0.19	0.22	0.13
To feel connected to nature	0.95	0.19	0.22	0.13
To clear one's head	0.67	0.13	0.15	0.09
To gain perspective on life	0.65	0.16	0.15	0.13
To learn about nature	0.57	0.37	0.20	0.39
To have memorable experiences	0.47	0.30	0.16	0.32
To have a sense of belonging	0.19	0.95	0.06	0.25
To feel that the site is part of oneself	0.17	0.89	0.09	0.22
To strengthen bonds with others	0.26	0.87	0.09	0.08
To miss the site	0.15	0.69	0.06	0.18
To find solitude	0.33	0.12	0.92	0.13
To have a sense of freedom	0.44	0.09	0.82	0.06
To feel part of something greater than oneself	0.23	0.54	0.12	0.75
To take care of the site	0.28	0.59	0.09	0.75
Proportion variance	0.35	0.25	0.12	0.10
Cumulative variance	0.35	0.60	0.72	0.82

The EFA resulted in eight items loading onto the first factor. Items were closely related with experiences, connections, and learning about nature such as "to have an aesthetic experience", "to feel connected to nature" and "to learn about nature". Some

items were associated with perceived therapeutic benefits of marine and coastal sites, such as “to feel healthier”, “to gain perspective on life” and “to clear one’s head”. To highlight the links between people, the natural environment and health, I labelled this factor *engagement with nature & health*. This factor explained the highest proportion of variance of survey data, that is 35% of variance.

Four items loaded onto a second factor related with interviewees’ place attachment, place identity, and place dependence towards local marine and coastal sites. These items were “to have a sense of belonging”, “to strengthen bonds with others”, “to feel that the site is part of oneself” and “to miss the site”. To emphasise the relationships between people and local marine and coastal sites, I labelled this factor *sense of place*. This factor explained 25% of variance in the dataset.

The items ‘to find solitude’ and “to have a sense of freedom” loaded onto a third factor. As the item related with solitude had the strongest factor loading of the two (0.92), I labelled this factor *solitude in nature*. This factor reflects the well-being that people derive from being alone in nature while experiencing a sense of freedom. Twelve percent of data variance was explained by this factor.

Equally, two items loaded onto a fourth factor. These items were related with spirituality—“to feel part of something greater than oneself”; and with caring—“to take care of the site”. I labelled this factor *spirituality*. This factor explained 10% of the survey data variance.

Effects of respondents’ socio-economic characteristics on cultural dimensions of well-being

Reported levels of well-being derived from marine and coastal sites varied significantly according to socio-economic characteristics of interviewees (**Figure 3**). I found significant differences in composite scores of the four factors. Composite scores of engagement with nature & health, sense of place, solitude in nature, and spirituality, varied depending on interviewees’ place of residence (that is, resident of the municipality

of Esposende vs. visitor; and rural vs. urban), level of formal education, household size, gender, and number of years living in the municipality of Esposende. All composite scores and corresponding statistical tests are shown in the supporting information of this chapter (**Table S2.4 supp info**).

Residents of Esposende rated higher than visitors the cultural benefits associated with engagement with nature & health ($W = 887966$, $df = 1$, $p < 0.001$), sense of place ($W = 247672$, $df = 1$, $p < 0.001$), and spirituality ($W = 247672$, $df = 1$, $p < 0.001$) (**Figure 3A**). Compared with urban interviewees, those living in a rural setting reported higher benefits from the four cultural dimensions of well-being (**Figure 3B**): engagement with nature & health ($W = 1104309$, $df = 1$, $p < 0.001$), sense of place ($W = 283403$, $df = 1$, $p < 0.001$), solitude in nature ($W = 69548$, $df = 1$, $p < 0.05$), and spirituality ($W = 59037$, $df = 1$, $p < 0.01$).

We also found significant differences of reported well-being according to the level of formal education (**Figure 3C**; **Table S2.4 supp info**). Those who had lower levels of formal education tended to report higher levels of cultural benefits provided by interactions with the marine environment. Comparing with interviewees with a university degree, those who attended high school reported significantly higher levels of benefits about engagement with nature & health ($Z = 2.53$, $df = 3$, $p.adj < 0.05$), and sense of place ($Z = 4.33$, $df = 3$, $p.adj < 0.001$). Similarly, comparing with university graduates, those who had an elementary or middle level of formal education reported higher levels of benefits about sense of place ($Z = 3.31$, $df = 3$, $p.adj < 0.01$; $Z = 4.63$, $df = 3$, $p.adj < 0.001$; respectively).

Interviewees living in households with more than four people rated significantly higher those benefits related with engagement with nature & health ($Z = 2.64$, $df = 2$, $p.adj < 0.05$), and with sense of place ($Z = 3.10$, $df = 2$, $p.adj < 0.01$), when comparing with households with two to four people. We also found significant differences in smaller households. Interviewees living alone attributed higher importance to the spiritual connections with the marine environment than those from bigger households ($Z = 2.45$, $df = 2$, $p.adj < 0.05$).

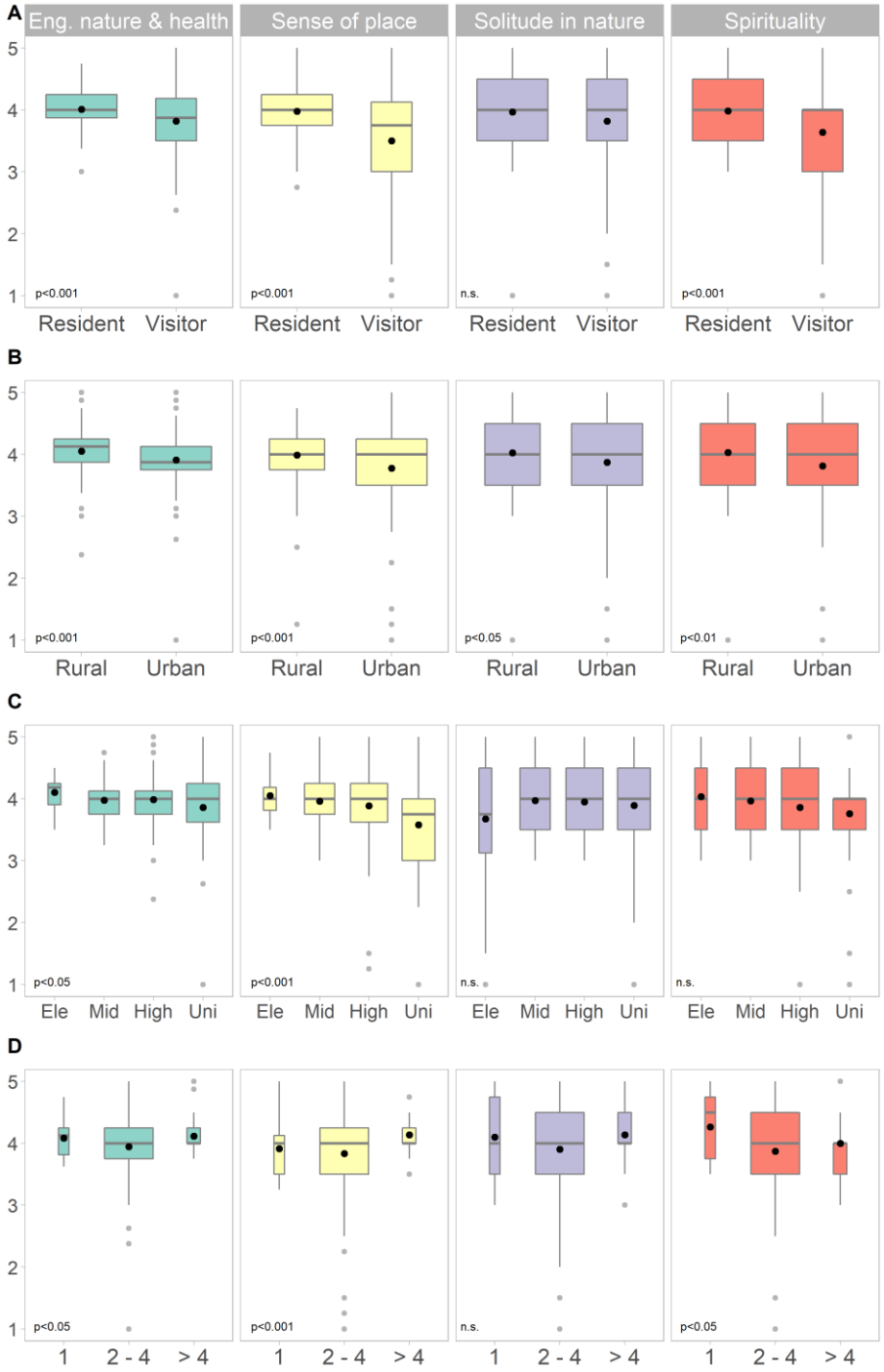

Figure 3. Composite scores of cultural dimensions of subjective well-being by socio-economic characteristics. Cultural dimensions of subjective well-being are engagement with nature & health, sense of place, solitude in nature, and spirituality. Socio-economic variables include: **A** – whether interviewee is a resident or visitor of the municipality of Esposende; **B** – whether interviewee lives in a rural or urban setting; **C** – formal education level; **D** – household size. Only variables with more than one significantly different dimensions are shown. Boxes range from the first (25th percentile) to the third (75th percentile) quartiles, and whiskers extend to the highest value that is within 1.5 times the first and third interquartile range. Data beyond the end of whiskers are outliers (grey dots). Median score is indicated by the horizontal line in the boxes. Black dots represent the mean score. Box widths are proportional to the square-roots of the number of observations in the groups.

Other socio-economic variables such gender and number of years living in the municipality of Esposende also revealed significant differences in composite scores (**Table S2.4 supp info**). Yet they differed only in one of the four cultural dimensions of subjective well-being. For example, interviewed women rated higher the spirituality interactions with marine and coastal sites ($W = 74024$, $df = 1$, $p < 0.05$). Also, comparing to residents of Esposende living for a long time in the municipality (that is, more than 20 years), residents more recently established in Esposende reported higher levels of benefits from solitude in marine and coastal environment ($W = 26120$, $df = 1$, $p < 0.05$). Other socio-economic variables such household income, employment and age did not affect significantly the reported levels of well-being derived from marine settings.

Effects of respondents' environmental behaviour on cultural dimensions of well-being

I found significant differences in interviewees' self-assessed levels of cultural benefits according to reported environmental behaviour (**Figure 4**). Variables of environmental behaviour with significant differences include the type of interactions between people and marine and coastal sites (that is, cognitive, physical, or both); interviewees' visit frequency to local beach and sea; amount of perceived benefits to human well-being provided by local marine and coastal sites; whether the interviewee had visited a protected area over the past year; and whether the interviewee read environmentally themed books/magazines. All composite scores and related statistical tests results are shown in the supporting information of this chapter (**Table S2.4 supp info**).

We asked people which activities they enjoyed doing the most when they were at the local beach or sea. There were cognitive and physical activities. I classified as cognitive activities those involving contemplation, reflection and thinking such as "observing nature", "reading" and "enjoying the seascape". In contrast, I classified as physical activities "diving", "hiking" and "playing beach football". Those activities that

combined cognitive and physical elements, I classified as "both". I recognise that arguably any human activity can be considered solely cognitive or physical, but for the sake of analysis I intended to stress the *main* elements of recreational activities in the marine environment. Results shown in **Figure 4A** reveal that, comparing with those who do mainly physical activities, people who do mostly cognitive activities in the marine environment reported significantly higher levels of well-being from engagement with nature & health ($Z = 3.82$, $df = 2$, $p.adj < 0.001$), and sense of place ($Z = 3.51$, $df = 2$, $p.adj < 0.01$). For the same well-being dimensions those who engage in both cognitive and physical activities reported significantly higher levels of well-being than those who do mainly physical activities ($Z = 3.10$, $df = 2$, $p.adj < 0.01$).

Interviewees' visiting frequency to local beaches also revealed differences in reported levels of well-being derived from the marine and coastal environment (**Figure 4B**). Those interviewees who admitted going frequently to local beaches reported significantly higher levels of well-being associated with sense of place than those who reported not going as often ($Z = 3.85$, $df = 2$, $p.adj < 0.001$). Similarly, people who recently had visited protected areas reported significantly higher levels of benefits associated to engagement with nature & health ($W = 555219$, $df = 1$, $p < 0.01$). On the other hand, for benefits related with sense of place and spirituality, those who had not visited protected areas over the past year had significantly higher scores ($W = 173452$, $df = 1$, $p < 0.001$; $W = 41447$, $df = 1$, $p < 0.05$; respectively). Lastly, interviewees who frequently read environmentally themed books and/or magazines revealed significantly higher benefits derived from engagement with nature & health than those who do not read them as frequently ($Z = 3.10$, $df = 3$, $p.adj < 0.05$). Other variables of environmental behaviour did not reveal statistically significant differences of responses. These variables include habits of buying environmentally certified food; recycling; whether the interviewee does outdoor activities; and type of preferred marine and coastal site (natural vs. with human-built elements). Likewise, knowledge and opinion

about the existence of Litoral Norte MPA did not reveal significant differences in interviewees' cultural dimension scores of subjective well-being.

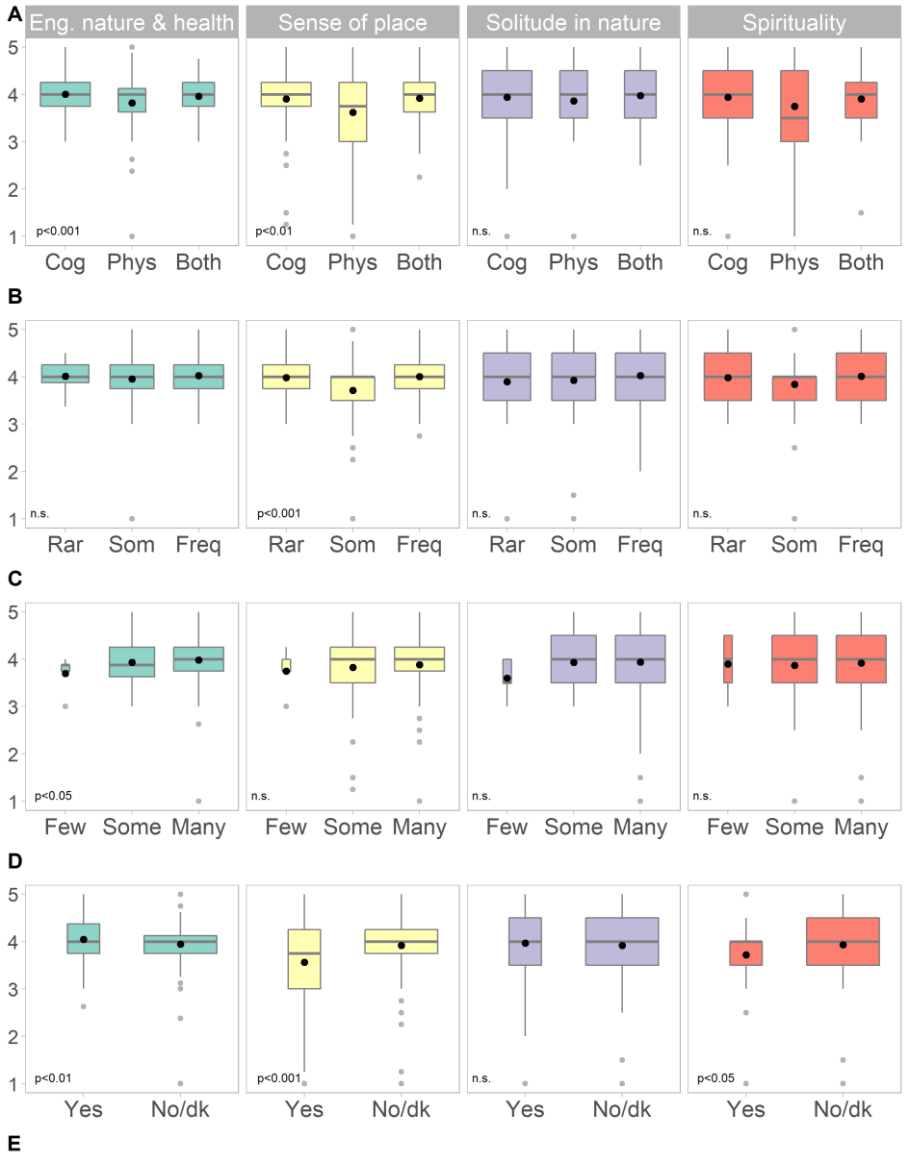

Figure 4. Composite scores of cultural dimensions of subjective well-being by reported environmental behaviour. Cultural dimensions of subjective well-being are engagement with nature & health, sense of place, solitude in nature, and spirituality. Reported environmental behaviour variables include: **A** – type of interaction with MPA sites (cognitive, physical, both); **B** – visit frequency to sea/beach (rarely, sometimes, frequently); **C** – amount of perceived benefits provided by sea/beach; **D** – if visited a protected are over the past year (yes, no/don't know); **E** – if reads environmentally themed books/magazines (never, rarely, sometimes, frequently). Boxes range from the first (25th percentile) to the third (75th percentile) quartiles, and whiskers extend to the highest value that is within 1.5 times the first and third inter-quartile range. Data beyond the end of whiskers are outliers (grey dots). Median score is indicated by the horizontal line in the boxes. Black dots represent the mean score. Box widths are proportional to the square-roots of the number of observations in the groups.

Discussion

Systematic subjective well-being assessments are rarely applied in ecosystem services science. Yet these assessments can be useful to shed light on the underlying reasons that lead people to engage with and care for the marine and coastal environment (Bryce et al., 2016). A deeper understanding of how people relate to non-human nature can help improve conservation outcomes (De Vos et al., 2018). Here I show that self-reported well-being derived from relating to, interacting with, and experiencing marine and coastal sites can be grouped onto four cultural dimensions of well-being. Based on EFA results, I interpreted cultural dimensions as *engagement with nature & health*, *sense of place*, *solitude in nature*, and *spirituality*. I do not claim that these cultural dimensions are mutually exclusive or separate. In fact, they may reflect intertwined elements of human well-being. An interesting finding was the significant differences in reported levels of cultural ecosystem benefits among the four cultural dimensions of well-being. These differences depended on interviewees' socio-economic characteristics and environmental behaviour. I discuss these findings below.

Cultural dimensions of well-being derived from the marine environment

People answered positively to all indicator statements of cultural well-being dimensions. Positive answers suggest that respondents experienced the cultural ecosystem benefits tested in the survey. A study reports similar finding for UK marine sites, although with slightly different well-being dimensions emerging from factor analysis (Bryce et al., 2016). Other empirical findings support the relevance of the cultural well-being dimensions that emerged from our data. First, the dimension *engagement with nature & health* is corroborated by medical studies that demonstrate the contributions of seas and coasts to self-reported general (Wheeler et al., 2012; White et al., 2013), physical (Bauman et al., 1999; Papathanasopoulou et al., 2016), and mental health

(Barton and Pretty, 2010; Nutsford et al., 2016). Engaging with seas and coasts is also positively associated with self-reported overall well-being (Busch et al., 2011; Koss and Kingsley, 2010).

Second, *sense of place*—the emotional bonds that people establish with places (van Putten et al., 2018)—is a key dimension of well-being for many communities of the world (Wynveen et al., 2012; Lin and Lockwood, 2014; Klain et al., 2014). Sense of place reflects people's attachment, rootedness, dependence, and sense of belonging to a physical space. It can contribute to the formation of people's identity, resulting in deep connections to marine and coastal sites (Urquhart and Acott, 2014).

Third, factor analysis revealed that the enjoyment of *solitude in nature* was closely related with sense of freedom experienced by being alone in the marine and coastal environment. Finding solitude in nature can be important for people to escape from everyday life (Wynveen et al., 2012). Solitude is also sought after by people to find peace, tranquillity, privacy, time for self-reflection, and spiritual development (Heintzman, 2009).

Lastly, *spirituality* emerged from items of perceived connections to metaphysical elements that exist beyond humans, and from needs of caring for sea and coastal sites. Studies often have focused on the spiritual connections between indigenous communities and nature (Oviedo and Jeanrenaud, 2007; Russell et al., 2013). But it has been shown that people of diverse backgrounds can feel deeply connected to ecosystems (Gould et al., 2014; Klain et al., 2014). Spiritual attachment to marine and coastal sites can be critical to the well-being of coastal communities (Klain et al., 2014).

Relational values underlie the cultural dimensions of well-being

The four cultural well-being dimensions that emerged from factor analysis support the notion of people valuing non-human nature relationally (Chan et al., 2016). Although ecosystem services frameworks have depicted mainly the benefit flows that humans receive from nature (MA, 2005; Haines-Young and Potschin, 2010), our results

suggest a bidirectional human-nature relationship. Meaning that interactions between people and nature are not merely based on instrumental values, that is nature's utility. As Himes and Muraca (2018) put it, "such [non-instrumental] relationships are not reducible to mere means to some humans' end, but constitute who we are as humans". Our study illustrates this point. For example, the dimension *sense of place* includes highly rated items associated with identities and feelings of belonging to local coastal sites. People also reported seeking the marine and coastal environment to feel healthier, connected, and inspired by nature, as suggested by the positive responses of *engagement with nature & health*. Moreover, interviewees reported a need of caring for their preferred sites in a survey item associated with *spirituality*. These results show that the importance, significance, and worth of non-human nature is intimately connected with people's relations, identities, and interactions with nature.

The notion of relational values about nature challenges the pervasive dichotomy between instrumental (nature's utility) and intrinsic values (nature's inherent worth) that has been guiding environmental ethics and biodiversity conservation (Muraca, 2011; Justus et al., 2009). Relational values broaden the outlook of environmental valuation enabling more pluralistic assessments of values (Arias-Arévalo et al., 2018). Broadening environmental valuation assessments by including relational values can provide stronger arguments to conserve or further protect areas that are important beyond their intrinsic or instrumental worth (Arias-Arévalo et al., 2017), such as Litoral Norte MPA. These arguments can help extend protection to those unprotected areas with deep human-nature connections that combine high relational and ecological values.

Socio-economic characteristics and environmental behaviour affect cultural dimensions of well-being

The cultural importance of Litoral Norte MPA sites varied significantly depending on people's socio-economic characteristics. Comparing to visitors, nearby residents of the

MPA reported significantly higher levels of ecosystem benefits related with the four cultural dimensions of well-being. This could be so because these are place-based benefits which are strongly related to people's connections and identities to local sites. By living near the MPA, residents have had more time and opportunities than visitors to establish deeper relationships with local sites. These deeper relationships might have resulted in increasing place-meaning, providing context for a deeper place attachment, and hence higher levels of well-being derived from those relationships Wynveen et al., 2012).

I have found significant differences in responses of rural and urban people. Interviewees living in a rural setting reported higher levels of cultural benefits related to MPA sites. Similarly, compared to interviewees with university degrees, those with lower levels of formal education (that is, elementary, middle, and high school) reported higher levels of benefits obtained from engagement with nature & health, and sense of place. These differences could be related because in our survey interviewees living in rural areas tended to have lower levels of formal education. Urban and rural differences in reported levels of cultural ecosystem benefits might be explained by the fact that people living in rural areas usually have a greater exposure to natural environments than urban people. Research shows that less opportunities to directly experience nature undermine health and well-being, changing people's affections, values, beliefs and interest towards nature (Soga and Gaston, 2016). As an increasing number of people live in urban areas, human-nature interactions tend to decline, leading to further alienation and indifference towards nature. This indifference can undermine both biodiversity conservation and human well-being (Turner et al., 2004). In an urbanised world the importance of human-nature interactions—especially in childhood (Zhang et al., 2014)—needs to reach vaster audiences.

Interviewees' environmental behaviour significantly affected responses about cultural ecosystem benefits. People who perceived Litoral Norte MPA sites as providing many benefits to human well-being reported significantly higher levels of benefits from engagement with nature & health. This is not surprising because people who

derive more well-being from being in nature are usually those who better recognise nature's benefits (Soga and Gaston, 2016). Policies aiming at reconnecting people and nature, such as educational and outreach programs, can help increase people's awareness of nature's benefits and help improve human well-being (Soga and Gaston, 2016).

Our results showed differences between cognitive and physical outdoor activities. People who engage mainly in cognitive outdoor activities such as observing nature or enjoying seascapes reported higher levels of benefits than those who do mainly physical activities such as diving or hiking. These differences were related to engagement with nature & health, and sense of place. These could be random differences because physical activities require cognitive interaction and the opposite may also be true. Yet, we need further research about the role of cognitive and physical activities in the outdoors to better understand their contributions to the cultural dimensions of well-being.

Insights for conservation practice and policy

This study offers several insights for conservation practice and policy. First, subjective well-being assessments can provide useful information for MPA managers and practitioners. These assessments can make explicit the reasons underlying the cultural importance of MPAs to people by eliciting relational values about nature. As shown by this study, relational values might include therapeutic, care, solitude, and spiritual values. This information is valuable because it can help prioritise conservation initiatives based on the underlying reasons of why people relate, connect and interact with the marine environment. Prioritising conservation initiatives based on relational and ecological values can help to strategically allocate limited resources to areas that combine both types of values. It can be a practical way of finding synergies between biodiversity conservation and human well-being (Bennett et al., 2015).

Second, conservation initiatives supported by subjective well-being assessments and relational values could receive a stronger support by local communities. Because

these assessments incorporate local people's values, they highlight the societal relevance of protected areas (De Vos et al., 2018). A relational values approach to conservation can be seen as more legitimate and appealing to local people, enabling extensive participation in conservation planning, designation and management. Local support and participation are often necessary conditions for positive conservation outcomes (Bennett and Dearden, 2014; Bennett et al., 2019).

Third, a relational values approach to conservation can strengthen the connections between people and non-human nature, increasing human well-being. By emphasising the relevance of MPAs to health, inspiration, identity, place attachment, freedom or spirituality, conservation initiatives may attract more people to experience nature. It can contribute to reconnect people and the biosphere (Folke et al., 2011). Decision-makers require a different approach in those geographies where conservation interventions create ethical and social justice issues by hindering people's access to places important for their identity and cultural practices (Outeiro et al., 2019). In these situations, decision-makers should engage local communities in open and transparent deliberative processes to avoid loss of legitimacy, social conflicts, and negative effects on biodiversity they intend to protect in the first place (Lele et al., 2010). Strengthening experiential, cognitive, emotional and even philosophical connections between people and non-human nature can play an important role in addressing current ecological and sustainability challenges (Ives et al., 2018).

Concluding remarks

This study's subjective well-being assessment has expanded the application of a new set of indicators of cultural ecosystem benefits developed by (Bryce et al., 2016) to a different geography. I have showed that both applications share similarities but have also important differences. To generalise the application of this set of indicators to different social and cultural contexts, future researchers should broaden, refine, and test further this set of indicators, by adding, for example, a 'solitude' indicator.

Applying a subjective well-being assessment to before-after, control-impact studies of conservation initiatives may offer promising insights. Here I have showed the importance of a multiple-use MPA in supporting four cultural dimensions of human well-being—engagement with nature & health, sense of place, solitude in nature, and spirituality—, and what promoting those cultural well-being dimensions imply for MPA practice and policy that aims to foster both biodiversity conservation and human well-being.

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Supporting information

Table S2.1. Questionnaire form used in the survey.

Uma equipa do Centro Interdisciplinar de Investigação Marinha e Ambiental e Universidade de Santiago de Compostela está a fazer um estudo sobre o bem-estar e a qualidade de vida que as pessoas obtêm do mar e das praias do concelho de Esposende. Para isso, temos entrevistado residentes e visitantes deste concelho para melhorar o conhecimento científico sobre as relações das pessoas com o ambiente marinho. Este inquérito é anónimo e voluntário. Não existem respostas certas nem erradas, apenas queremos saber a sua opinião.

SECÇÃO A. Residente ou visitante do concelho de Esposende

1. É residente no concelho de Esposende, ou está de visita?	☐ Residente *[ir para 1.1]* ☐ Visitante *[ir para 1.2]*
1.1. *[Se residente]* Desde que ano reside no concelho de Esposende?	
1.2. *[Se visitante]* É a primeira vez que visita o concelho de Esposende?	☐ Sim *[ir para 3]* ☐ Não *[ir para 1.3]*
1.3. *[Se visitante]* Com que frequência costuma visitar o concelho de Esposende?	☐ Todos os anos ☐ Todos os meses ☐ Todas as semanas ☐ Outro:
2. Com que frequência vai à praia ou ao mar aqui no concelho de Esposende? *[Se nunca, terminar a entrevista]*	☐ Frequentemente ☐ Às vezes ☐ Raramente ☐ Nunca *[terminar entrevista]*
3. *[Se visitante 1ª vez]* Já teve oportunidade de visitar alguma praia aqui do concelho, ou de apreciar a vista para o mar?	☐ Sim *[ir para 4]* ☐ Não *[terminar entrevista]*
4. *[Se visitante 1ª vez]* O que fez quando esteve na praia ou no mar?	
5. O que costuma fazer quando vai à praia ou ao mar aqui no concelho?	

SECÇÃO B. Percepções sobre o bem-estar conferido pelo ambiente marinho

As próximas perguntas são sobre a nossa relação com o mar e as praias.

6. Considera que o mar e as praias do concelho de Esposende beneficiam, ou não beneficiam, o bem-estar e a qualidade de vida das pessoas que visitam ou residem no concelho?	☐ Sim, beneficiam ☐ Não beneficiam ☐ Não sei
6.1. *[Se sim]* Quantos benefícios?	☐ Muitos ☐ Alguns ☐ Poucos ☐ Nenhum
6.2. *[Se sim]* Pode dar exemplos de benefícios que considera importantes? *[Apontar todos os benefícios indicados]*	

1

Agora gostaria que pensasse num local do concelho de Esposende que tenha visitado, relacionado com o mar, e que considera importante, único ou especial.

7. Qual é esse local? *[Apontar nome do local. No caso de dificuldade em nomear um local, pedir para identificar no mapa]*	☐ Local: ☐ Nenhum *[terminar entrevista]*
7.1. Que características do/a *[nome do local]* o/a levam a gostar de o/a visitar?	

Peço agora que pense num local aqui do concelho de Esposende que é o contrário do/a *[nome do local]*.

8. Que local, relacionado com o mar, considera desagradável, descuidado ou problemático? *[Apontar nome do local. No caso de dificuldade em nomear um local, pedir para identificar no mapa]*	☐ Local: ☐ Nenhum
8.1. Que características do local o/a levam a <u>não</u> gostar de o/a visitar?	

9. As próximas perguntas são sobre variadas maneiras pelas quais *[o local identificado na pergunta 7]* pode ser importante para si. Indique por favor o seu grau de concordância com as seguintes frases, numa escala de 1 a 5 *[mostrar escala ao/à entrevistado/a]*. Sendo 1 – discordo totalmente; 2 – discordo; 3 – nem concordo, nem discordo; 4 – concordo; e 5 – concordo totalmente.

Frase	**Escala**
a. Tive bastantes experiências memoráveis *[<u>no local</u>]*.	1 – 2 – 3 – 4 – 5
b. Sinto falta *[<u>do local</u>]* quando estou longe dele por muito tempo.	1 – 2 – 3 – 4 – 5
c. Aprendo sobre a natureza quando estou *[<u>no local</u>]*.	1 – 2 – 3 – 4 – 5
d. Estar *[<u>no local</u>]* faz-me sentir mais saudável.	1 – 2 – 3 – 4 – 5
e. Se não pudesse aceder *[<u>ao local</u>]* a minha vida seria pior.	1 – 2 – 3 – 4 – 5
f. Sinto que *[<u>o local</u>]* faz parte de mim e eu faço parte dele.	1 – 2 – 3 – 4 – 5
g. Sinto-me emocionado/a com a beleza *[<u>do local</u>]*.	1 – 2 – 3 – 4 – 5
h. *[<u>No local</u>]* sinto que faço parte de algo superior a mim.	1 – 2 – 3 – 4 – 5
i. Sinto que posso contribuir para cuidar *[<u>do local</u>]*.	1 – 2 – 3 – 4 – 5
j. *[<u>O local</u>]* transmite-me um sentimento de liberdade.	1 – 2 – 3 – 4 – 5
k. Fiz ou reforcei laços familiares ou de amizade quando estive *[<u>no local</u>]*.	1 – 2 – 3 – 4 – 5
l. *[<u>No local</u>]* posso estar sozinho/a e apreciar a solidão.	1 – 2 – 3 – 4 – 5
m. *[<u>O local</u>]* inspira-me.	1 – 2 – 3 – 4 – 5
n. *[<u>O local</u>]* é muito importante para o meu sustento e o da minha família.	1 – 2 – 3 – 4 – 5
o. O que apanho *[<u>no local</u>]* é importante para a minha alimentação.	1 – 2 – 3 – 4 – 5
p. Ponho as minhas preocupações em perspectiva quando estou *[<u>no local</u>]*.	1 – 2 – 3 – 4 – 5
q. Estar *[<u>no local</u>]* faz-me sentir mais ligado/a à natureza.	1 – 2 – 3 – 4 – 5
r. Quando estou *[<u>no local</u>]* não penso em mais nada.	1 – 2 – 3 – 4 – 5

10. Desta lista de frases sobre *[<u>o local</u>]*, quais são as **<u>3 frases mais importantes</u>** para si?

Frase	**10.1.** Ordene a frase **por importância**: *1) Algo importante* *2) Muito importante* *3) A mais importante*	**10.2.** Nos **últimos 10 anos**, em relação a essa frase, acha que o local está: *1) Pior 2) Igual* *3) Melhor 4) Não sabe/não conhecia o local há 10 anos*	**10.3.** Por que razão acha que está **pior**/**melhor**? *[justificar com uma/duas palavras]*

SECÇÃO C. Conhecimento e opinião sobre o Parque Nacional do Litoral Norte

11. Nos **últimos 10 anos** acha que o mar e as praias do concelho de Esposende:	☐ Melhoraram muito ☐ Melhoraram ☐ Pioraram ☐ Pioraram muito ☐ Não conhecia o local há 10 anos
11.1. Porquê?	
12. Sabia que o mar e as praias do concelho de Esposende estão dentro de um parque marinho e por isso são protegidos por lei?	☐ Sim ☐ Não
13. Concorda com a existência do parque marinho aqui no concelho de Esposende?	☐ Sim ☐ Não ☐ Não sei
13.1. *[Se sim/não]* Porquê?	
14. Que importância tem o parque marinho para o bem-estar e qualidade de vida dos **residentes** do concelho de Esposende?	☐ Muito importante ☐ Importante ☐ Pouco importante ☐ Sem importância
15. Que importância tem o parque marinho para o bem-estar e qualidade de vida dos **visitantes** do concelho de Esposende?	☐ Muito importante ☐ Importante ☐ Pouco importante ☐ Sem importância
16. Que importância tem o parque marinho para o bem-estar e qualidade de vida das **gerações futuras** que viverão no concelho de Esposende?	☐ Muito importante ☐ Importante ☐ Pouco importante ☐ Sem importância

SECÇÃO D. Comportamento Ambiental

17. Costuma praticar actividades ao ar livre?	☐ Sim ☐ Não
17.1. *[Se sim]* quais?	

18. É membro de alguma associação?	☐ Sim ☐ Não
18.1. *[Se sim]* De que tipo?	☐ Ambiental ☐ Social ☐ Trabalho ☐ Recreio ☐ Outra:
19. Lê livros ou revistas sobre temas ambientais?	☐ Frequentemente ☐ Às vezes ☐ Raramente ☐ Nunca
20. Compra alimentos com certificação ambiental?	☐ Frequentemente ☐ Às vezes ☐ Raramente ☐ Nunca
21. Recicla ou separa o lixo em casa?	☐ Frequentemente ☐ Às vezes ☐ Raramente ☐ Nunca
22. Visitou alguma área protegida neste ou no último ano?	☐ Sim ☐ Não ☐ Não sei
22.1. *[Se sim]* Qual/quais?	
23. A sua participação cívica é activa (participa em assembleias de freguesia/municipais, reuniões de associações)?	☐ Sim ☐ Não
24. *[Se residente]* Considera que a sua opinião é tida em conta na tomada de decisões no concelho de Esposende?	☐ Sim ☐ Não
24.1. Porquê?	

SECÇÃO E. Informação socio-económica

Para finalizar, gostaria de saber…

25. Em que ano nasceu?	
26. Qual é o seu nível de escolaridade?	☐ Ensino Superior ☐ Ensino Secundário (10 – 12) ☐ Ensino Básico 2º/3º ciclos (5 – 9) ☐ Ensino Básico 1º ciclo (1 – 4) ☐ Nenhum ☐ Outro:
27. Está empregado/a?	☐ Sim ☐ Não
27.1. *[Se sim]* Qual é a sua ocupação profissional? *[Se aposentado/a: o que fazia antes?]*	
28. Considera que vive numa zona urbana ou rural?	☐ Urbana ☐ Rural
29. Qual é a freguesia e o concelho onde reside a maior parte do tempo?	Freguesia: Concelho:

30. Qual é o **rendimento mensal aproximado** (ex., salários, pensões, rendas, subsídios) do seu **agregado familiar**, antes de descontar impostos?	☐ < 500€ ☐ 500€ – 799€ ☐ 800€ – 1099€ ☐ 1100€ – 1399€ ☐ 1400€ – 1699€ ☐ 1700€ – 1999€ ☐ 2000€ – 2299€ ☐ 2300€ – 2599€ ☐ > 2599€ ☐ Não responde
31. Quantas pessoas vivem em sua casa?	
32. Quantos adultos vivem em sua casa?	

Muito obrigado por ter colaborado e participado neste inquérito. As suas respostas são muito importantes para o nosso estudo. Caso necessite de algum esclarecimento adicional, não hesite em contactar-nos. *[Deixar contacto]*

[A completar pelo/a entrevistador/a]

33. Género do/a entrevistado/a	☐ M ☐ F
34. Local da entrevista (freguesia)	
35. Data	
36. Entrevistador/a	

Table S2.2. Loadings and eigen values of the categorical principal component analysis.

Abbreviated indicator statements	Dimension 1	Dimension 2	Dimension 3
To have memorable experiences	0.714298	-0.02345	-0.0808
To miss the site	0.598441	-0.49686	-0.06013
To learn about nature	0.845859	-0.02638	-0.06406
To feel healthier	0.881031	0.405243	-0.15038
To feel that the site is part of oneself	0.687807	-0.60541	0.078279
To have a sense of belonging	0.724092	-0.6312	0.051497
To have an aesthetic experience	0.881557	0.404443	-0.15096
To feel part of something greater than oneself	0.726904	-0.46274	0.075763
To take care of the site	0.772704	-0.46302	0.048643
To have a sense of freedom	0.623691	0.416265	0.625539
To strengthen bonds with others	0.725044	-0.50228	0.003007
To find solitude	0.620736	0.322964	0.684463
To feel inspired	0.881319	0.404683	-0.14979
To gain perspective on life	0.703906	0.249415	-0.22745
To feel connected to nature	0.881154	0.405545	-0.14908
To clear one's head	0.672878	0.305191	-0.2442
Eigen values	9.061436	2.78281	1.092442

Figure S2.3. Scree plot of the categorical principal component analysis.

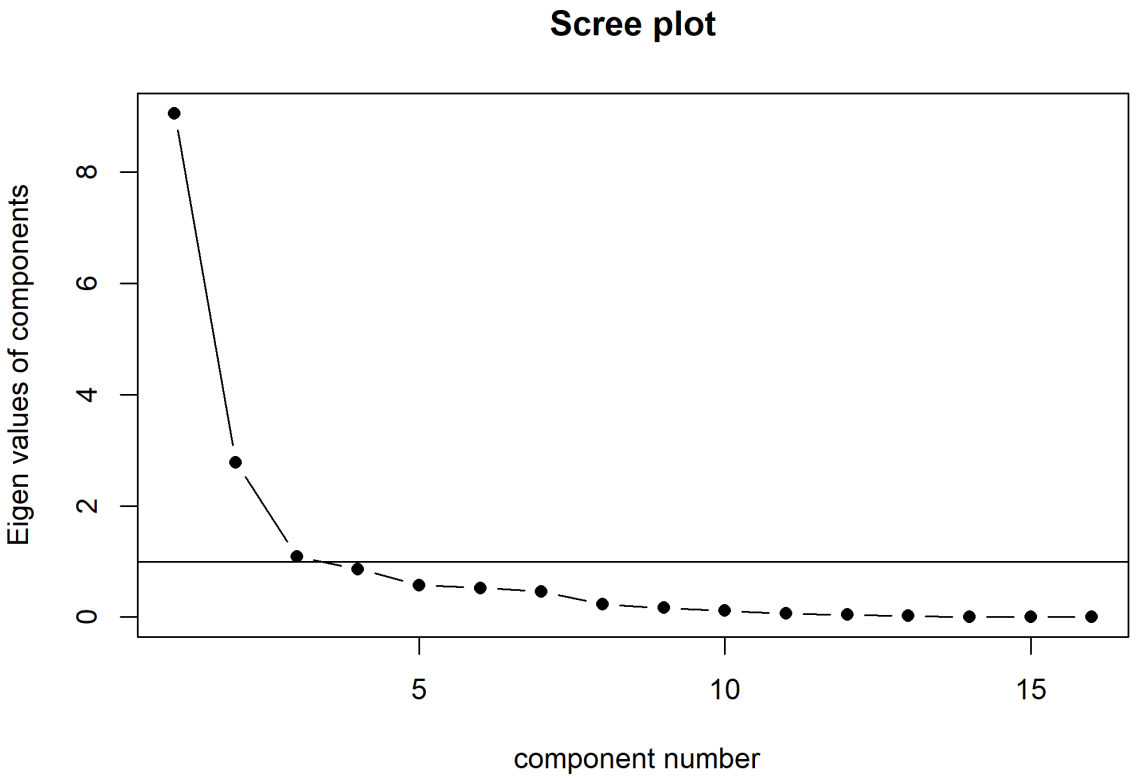

Table S2.4. Statistical tests, means and standard deviations of survey variables. Statistical tests include Kruskall-Wallis, Wilcoxon rank-sum, and Dunn tests.

Variable	Responses	Eng. nature & health		Sense of place		Solitude in nature		Spirituality	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Resident/visitor	resident	4.01	0.29	3.98	0.42	3.97	0.64	3.98	0.60
	visitor	3.82	0.61	3.50	0.91	3.82	0.76	3.64	0.84
	W	887966	***	247672	***	53910	ns	59037	***
Rural/urban	rural	4.05	0.35	3.99	0.51	4.03	0.65	4.03	0.61
	urban	3.91	0.43	3.78	0.65	3.87	0.68	3.82	0.71
	W	1104309	***	283403	***	69548	**	71527	*
Education	elementary	4.11 a	0.31	4.05 a	0.39	3.68 a	1.25	4.04 a	0.60
	middle	3.98 a	0.30	3.96 a	0.46	3.97 a	0.52	3.97 a	0.62
	high school	3.99 a	0.38	3.89 a	0.61	3.95 a	0.59	3.86 a	0.76
	university	3.86 b	0.54	3.58 b	0.79	3.89 a	0.75	3.76 a	0.71
	chi sq	10.67	*	30.21	***	0.80	ns	4.79	ns
Household size	1	4.08 a	0.84	3.92 a	0.85	4.10 a	0.85	4.27 a	0.79
	2 – 4	3.95 a	0.84	3.83 a	0.86	3.91 a	0.86	3.87 a	0.87
	> 4	4.12 b	0.76	4.14 b	0.86	4.14 a	0.86	4.00 b	0.70
	chi sq	9.21	*	9.67	**	4.71	ns	6.68	*
Employed	yes	3.93	0.50	3.92	0.59	3.83	0.75	3.84	0.65
	no	3.98	0.37	3.84	0.62	3.96	0.64	3.91	0.69
	W	768143	ns	205871	ns	45529	ns	46716	ns
Household income	< 500€	3.75 a	0.97	3.81 a	1.03	4.00 a	1.17	3.88 a	1.07
	500-799€	4.07 a	0.40	3.81 a	0.76	3.98 a	0.76	3.74 a	0.76
	800-1099€	3.92 a	0.33	3.95 a	0.46	3.94 a	0.56	3.92 a	0.66
	1100-1399€	3.87 a	0.43	3.85 a	0.60	3.78 a	0.68	3.81 a	0.62
	1400-1699€	4.03 a	0.36	3.84 a	0.56	3.80 a	0.80	3.91 a	0.73
	1700-1999€	4.00 a	0.37	3.93 a	0.74	4.16 a	0.64	3.98 a	0.60
	2000-2299€	4.02 a	0.35	3.80 a	0.54	4.11 a	0.66	4.13 a	0.58
	2300-2599€	3.96 a	0.19	3.75 a	0.90	4.50 a	0.50	3.83 a	0.58
	>2599€	3.89 a	0.42	3.81 a	0.61	3.91 a	0.55	3.91 a	0.61
	chi sq	18.00	*	5.92	ns	13.92	ns	8.19	ns
Gender	female	3.96	0.42	3.87	0.57	3.97	0.66	3.98	0.66
	male	3.97	0.39	3.85	0.66	3.89	0.68	3.82	0.69
	W	1071053	ns	269478	ns	70542	ns	74024	*
Age	<30	4.04 a	0.80	3.96 a	0.85	4.04 a	0.84	3.98 a	0.86
	30 – 49	3.92 a	0.85	3.78 a	0.95	3.90 a	0.85	3.83 a	0.84
	50 – 69	3.97 a	0.83	3.90 a	0.94	3.93 a	0.87	3.85 a	0.90
	> 70	4.10 b	0.73	3.93 a	0.82	3.59	0.96	4.09 a	0.81
	chi sq	8.92	*	7.24	ns	4.50	ns	4.58	ns
Years living in the municipality	<=20	4.02	0.81	4.02	0.81	3.87	0.85	3.98	0.80
	>20	3.98	0.82	3.92	0.84	4.07	0.84	4.01	0.81
	W	491283	ns	127452	ns	26120	*	29191	ns
Outdoor activities	yes	3.95	0.34	3.91	0.53	3.92	0.63	3.94	0.71
	no	3.98	0.46	3.81	0.68	3.94	0.72	3.85	0.65
	W	1049550	ns	281203	ns	66047	ns	71825	ns
	frequently	4.03 a	0.34	4.00 a	0.43	4.03 a	0.69	4.01 a	0.56

Visit frequency sea/beach	sometimes	3.95 a	0.47	3.71 b	0.73	3.93 a	0.71	3.84 a	0.66
	never	na	na	na					
	chi sq	1.94	ns	16.99	***	2.30	ns	3.79	ns
Amount benefits provided by MPA to well-being	many	3.98 a	0.43	3.88 a	0.65	3.94 a	0.75	3.92 a	0.65
	some	3.93 a	0.39	3.83 a	0.59	3.93 a	0.55	3.87 a	0.70
	few	3.70 a	0.40	3.75 a	0.47	3.60 a	0.42	3.90 a	0.65
	chi sq	8.25	*	2.87	ns	2.10	ns	0.51	ns
Type of preferred site	natural	3.96	0.42	3.84	0.59	3.90	0.66	3.93	0.71
	w/ human-made elements	3.97	0.38	3.90	0.65	3.98	0.70	3.84	0.64
	W	989005	ns	237159	ns	58932	ns	66571	ns
Type of interaction with MPA sites	cognitive	4.01 a	0.32	3.91 a	0.53	3.94 a	0.65	3.94 a	0.64
	physical	3.82 b	0.62	3.62 b	0.87	3.86 a	0.74	3.75 a	0.83
	both	3.97 a	0.36	3.92 a	0.54	3.98 a	0.62	3.90 a	0.66
	chi sq	14.63	***	13.44	**	0.89	ns	3.93	ns
Read frequency environmenal books/mags	frequently	4.02 a	0.43	3.91	0.57	3.96	0.68	3.96	0.71
	sometimes	3.91 b	0.36	3.78	0.66	3.96	0.62	3.91	0.62
	rarely	3.95 a	0.41	3.83	0.64	3.91	0.66	3.74	0.70
	never	3.96 a	0.41	3.94	0.56	3.82	0.77	3.96	0.69
	chi sq	10.06	*	5.56	ns	1.80	ns	7.49	ns
Buying frequency env. certified food	frequently	4.00	0.44	3.91	0.58	4.02	0.69	3.95	0.70
	sometimes	3.92	0.36	3.78	0.76	3.90	0.67	3.84	0.72
	rarely	3.95	0.42	3.85	0.50	3.87	0.63	3.91	0.58
	never	4.01	0.36	3.91	0.55	3.91	0.73	3.85	0.76
	chi sq	6.65	ns	3.44	ns	4.48	ns	1.91	ns
Recycling frequency	frequently	3.96	0.41	3.87	0.61	3.91	0.69	3.91	0.66
	sometimes	4.00	0.35	3.82	0.62	3.97	0.64	3.85	0.74
	rarely	3.96	0.43	3.92	0.51	3.99	0.69	3.97	0.66
	never	3.95	0.52	3.75	0.79	3.88	0.53	3.69	0.83
	chi sq	1.23	ns	1.30	ns	0.70	ns	1.56	ns
PA visit	yes	4.05	0.49	3.57	0.91	3.97	0.81	3.72	0.81
	no/don't know	3.95	0.38	3.92	0.51	3.92	0.64	3.93	0.65
	W	555219	**	173452	***	35646	ns	41447	*
Knowledge about existence of MPA	yes	3.94	0.48	3.84	0.62	3.91	0.72	3.93	0.72
	no	3.98	0.35	3.87	0.61	3.94	0.65	3.88	0.66
	W	966800	ns	241886	ns	60980	ns	63824	ns
Agreement with existence of MPA	yes	3.92	0.51	3.82	0.62	3.84	0.69	3.88	0.75
	no	3.98	0.35	3.88	0.61	3.97	0.66	3.90	0.65
	W	862200	ns	213186	ns	51248	ns	55824	ns

Asterisks indicate significant differences of responses after applying Kruskall-Wallis tests and Wilcoxon rank-sum tests (*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$)
Values marked with the same letter are not significantly different, after applying Dunn tests ($p < 0.05$)
SD = standard deviation

Table S2.5. Descriptive statistics of the survey sample (N=367).

Dimension	Variable	Response	N	% N
Socio-economic	If interviewee lives in Esposende (the municipality where the MPA is located) or not	Resident	276	75.2
		Visitor	91	24.8
	If interviewee lives in a rural or urban setting	Rural	138	37.6
		Urban	229	62.4
	Completed education level	Elementary (4 years)	14	3.8
		Middle (9 years)	79	21.5
		High (12 years)	119	32.4
		University	93	25.3
		NA	62	16.9
	Household size	1	15	4.1
		2 – 4	327	89.1
		> 4	25	6.8
	If interviewee is employed	Yes	279	76.0
		No	88	24.0
	Household income	< 500€	12	3.3
		500-799€	54	14.7
		800-1099€	61	16.6
		1100-1399€	34	9.3
		1400-1699€	28	7.6
		1700-1999€	32	8.7
		2000-2299€	27	7.4
		2300-2599€	3	0.8
		> 2599€	22	6.0
		NA	94	25.6
	Gender	Female	179	48.8
		Male	188	51.2
	Age	< 30	56	15.3
		30 – 49	161	43.9
		50 – 69	74	20.2
		> 70	11	3.0
		NA	47	12.8
	If resident: number of years living in Esposende (the municipality where the MPA is located)	≤ 20	103	28.1
		> 20	145	39.5
		NA	119	32.4
Environmental attitudes	If interviewee does outdoor activities often	Yes	179	48.8
		No	188	51.2
	How frequent the interviewee goes to local sea and/or beaches	Frequently	117	31.9
		Sometimes	89	24.3
		Rarely	105	28.6
		Never	0	0.0
		NA	56	15.3
	Amount of perceived benefits provided by MPA to human well-being	Many	177	48.2
		Some	145	39.5

		Few	5	1.4
		None	0	0.0
		NA	40	10.9
	Type of interviewee's preferred MPA site	Natural	233	63.5
		W/ human-made elements	134	36.5
	Type of interviewee's interaction with MPA sites	Cognitive	214	58.3
		Physical	65	17.7
		Both	87	23.7
		NA	1	0.3
	How frequent the interviewee reads environmentally themed books and/or magazines	Frequently	128	34.9
		Sometimes	100	27.2
		Rarely	84	22.9
		Never	55	15.0
	How frequent the interviewee buys environmentally certified food	Frequently	119	32.4
		Sometimes	105	28.6
		Rarely	99	27.0
		Never	44	12.0
	How frequent the interviewee recycles	Frequently	235	64.0
		Sometimes	77	21.0
		Rarely	39	10.6
		Never	16	4.4
	If interviewee visited a protected area the previous year	Yes	61	16.6
		No	237	64.6
		Don't know	69	18.8
Knowledge and opinion about MPA existence	Knowledge about the existence of the MPA	Yes	238	64.9
		No	129	35.1
	Agreement with the existence of the MPA	Yes	260	70.8
		No	16	4.4
		Don't know	91	24.8

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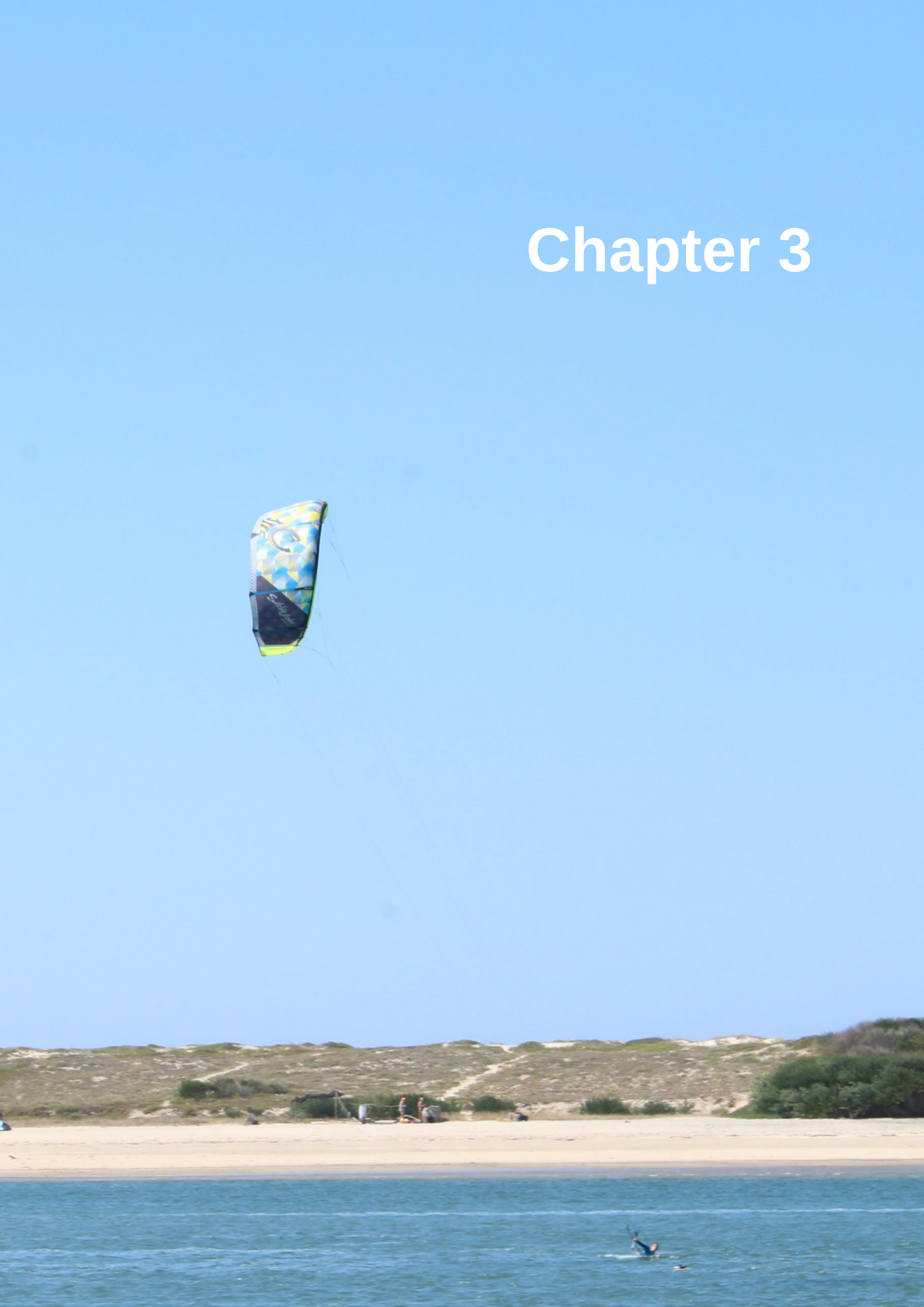
Chapter 3



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3.
Articulating stakeholders' perceptions to inform Litoral Norte MPA management

Introduction

Marine protected areas (MPAs) are widespread marine management tools (UNEP-WCMC and IUCN, 2019). They are promoted and designated for different purposes: to conserve biodiversity (Lester et al., 2009), to improve fisheries management (Cinner et al., 2016), to protect ecosystem service provision (Potts et al., 2014), to enhance tourism (Sala et al., 2013), or to achieve a combination of these goals (Jupiter et al., 2014). MPA governance arrangements are also diverse, ranging from co-management, community-based, to state-led MPAs (Mascia, 2004). These different governance arrangements may include no-take zones where extractive activities are prohibited, or multiple-use protected areas in which a diverse and varying set of human activities are allowed but regulated. While MPAs can improve both human well-being and biodiversity conservation (Mascia et al., 2010; Ban et al., 2019) by providing positive ecological (e.g., Lester et al., 2009; Edgar et al., 2014; Rojo et al., 2019) and social outcomes (e.g., Timko and Satterfield, 2008; Oldekop et al., 2016), their long-term success often

depends on the acceptance and support by local communities (Pita et al., 2011; Voyer et al., 2015; Yates et al., 2019).

MPAs are often established near coastal communities whose well-being depend on locally provided ecosystem services (e.g., Jentoft et al., 2012; Mahajan and Daw, 2016; Lopes and Villasante, 2018). After designation, MPAs can enhance or decrease ecosystem service provision by restricting or allowing human activities (Pascual et al., 2016). For example, MPAs can entail ecosystem service trade-offs such as opportunities for tourism instead of fishing (Jentoft et al., 2012). MPAs can also give rise to synergies such as maintenance of habitats and species, and harvestable fish through "spillover" (Lester et al., 2009). In this context, it is useful to understand local communities' perceptions of ecosystem services and related well-being benefits, as changes in ecosystem services provision after the establishment of MPAs may determine approval or disapproval for marine conservation initiatives.

The study of perceptions can help elicit the underlying reasons that explain local communities' approval or disapproval of MPAs (Bennett, 2016). For example, social approval of conservation initiatives can be high among fishers if MPAs are perceived of providing benefits to local fisheries and ecosystems (Leleu et al., 2012). Local fishers' support of MPAs can be influenced by perceptions of ecological effectiveness, social impact management and good governance processes (Bennett et al., 2019). Similarly, support and approval of MPAs can be high among those stakeholders who perceive that the MPA provides community and environmental benefits (McNeill et al., 2018). While understanding how local stakeholders perceive social and ecological outcomes of MPAs can help explain support or opposition to these marine management tools, the study of perceptions remains surprisingly scant in the context of marine conservation (Bennett, 2016).

Perceptions can be defined as "the way an individual observes, understands, interprets, and evaluates a referent object, action, experience, individual, policy, or outcome" (Bennett, 2016). Perceptions are subjective interpretations of reality. They are shaped by attitudes, beliefs, values, norms and motivations (Levine et al., 2015;

Bennett, 2016). In the context of conservation, the study of perceptions can provide complementary evidence to quantitative assessments of social and ecological outcomes of MPAs. Evidence from perceptions hardly involves complex protocols or high costs, and allows for co-learning, participation and easy incorporation of insights into conservation practice and policy (Webb et al., 2004; Bennett, 2016). Although useful, the study of perceptions has limitations that should be acknowledged. Perceptions should not be used to infer causality without counterfactual evidence; self-reported perceptions can be purposefully inaccurate; and they may not correctly represent outcomes (Bennett, 2016). Nevertheless, exploring mismatches of positive and negative perceptions of who manages and who uses local resources may reveal pathways and barriers to MPA success.

To test the assumption that positive perceptions are associated with increased support for MPAs (Bennett, 2016), I explore in this chapter stakeholders' perceptions of Litoral Norte MPA (see the "study area" section of chapter 1 for more details). To that end, I aim to:

- examine stakeholders' positive and negative opinions of Litoral Norte MPA governance and management;
- understand stakeholders' perceptions of ecosystem services, human well-being attributes, pressures and trends in the MPA since its designation;
- articulate stakeholders' perceptions to help identify management actions for Litoral Norte MPA.

Methods

I used a mixed-methods approach to elicit stakeholders' perceptions of Litoral Norte MPA. This approach entails a qualitative thematic analysis and a quantitative network analysis based on interview and focus group data. Although semi-structured interviews and focus group discussions can produce different information about the same

topic (Kaplowitz and Hoehn, 2001), they can also generate comparable data (Hicks et al., 2013; Yates et al., 2019). To that end, I interviewed stakeholders and facilitated the focus group sessions—using similar question guides—to ensure the collection of comparable data.

Data collection

I designed and carried out semi-structured interviews and focus group discussions with key MPA stakeholder groups (**Table 4**). Key stakeholder groups were defined as those who play a professional role in the on-going governance and management of the MPA, and those whose livelihoods depend on the MPA's marine resources. As a result, key stakeholders included MPA managers, scientists, fishers, fish vendors, and maritime tourism operators. Interviews were semi-structured because contrary to more structured approaches they allow for a detailed, in-depth exploration of interviewees' perceptions, motivations, attitudes and beliefs (Bernard et al., 2016). To that end, I developed an interview guide with 14 open-ended questions. The interview guide covered topics such as the social and ecological importance of the area, MPA establishment and development, existing threats and conflicts, and governance and management issues.

Table 4. Number and type of stakeholders who were interviewed or participated in focus groups discussions.

Stakeholder type	Sector/Group	Data collection method	No. interviewees/ attendees
MPA manager	Institute for Conservation of Nature Environmental municipal councillor	Semi-structured interview	3
Scientist	Marine biology Marine ecology Naval history Underwater archaeology	Semi-structured interview	5
Fisher	Commercial fishers' association Commercial small-scale fisheries	Semi-structured interview	3
Fish vendor	Fish market Street sales	Semi-structured interview	2
Maritime tourism operator	Nautical recreation (kitesurf, surf, diving) Recreational fisheries	Semi-structured interview	4
Fisher	Commercial small-scale fisheries	Focus group discussion	6

Fish vendor	Fish market Street sales	Focus group discussion	3
Maritime tourism operator	Nautical recreation (kitesurf, surf, stand-up paddle, jet skiing, diving)	Focus group discussion	3
Total			29

Overall, I carried out 17 one-to-one in-depth semi-structured interviews in Esposende—the municipality where the Litoral Norte MPA is located—, between March and December of 2017. Interviews lasted about 1 hr 3 min on average, ranging from 25 min to 1 hr 40 min. All interviews were recorded with a digital voice recorder for later transcription, resulting in 18 hr of audio recordings. I contacted known relevant interviewees either by e-mail or phone. These contacts resulted in interviews to MPA managers and scientists who then indicated other potential interviewees in what was a purposive snowball sampling approach (Goodman, 1961). I stopped searching for further interviewees when interview themes reached data saturation (Guest et al., 2006).

To increase stakeholder participation in the study and to maximise the available financial and logistical resources, I engaged MPA resource user groups in three focus group discussions. The objective of the focus group discussions was to elicit perceptions and opinions of those stakeholder groups potentially most affected by the creation of the MPA and whose livelihoods depended most on locally provided ecosystem services and related well-being benefits. We did focus group sessions with three separate homogenous groups of fishers, fish vendors and maritime tourism operators (**Table 4**). Group member homogeneity, that is groups with members of similar background such as fishers, is important for the quality of the group's output because homogenous group members are generally more open and comfortable with each other (Morgan and Krueger, 1997). Previous semi-structured interviews were vital to prepare the focus group discussions because they allowed me to have a deeper understanding of the social and ecological issues relevant to stakeholder groups. Topics of focus groups overlapped with those of semi-structured interviews but were tailored for each session.

Focus group discussions were held on February 2018 at the premises of the local commercial fishers' association, located in the vicinity of the MPA. The sessions

involved three to six participants and lasted 1 hr 41 min on average, ranging from 1 hr 20 min to 2 hr 16 min. Focus group sessions were audio and video recorded for later transcription, resulting in 5 hr of audio and video footage. Our research team was composed by one facilitator and one note taker whose task was to document insights arising in the discussions.

To arrange the focus group discussions, I used a convenience sampling approach and invited first those fish vendors and maritime tourism operators already known to the research team. Yet, to recruit more participants, we asked fish vendors and maritime tourism operators—those we already knew—to identify other potentially relevant participants, who were then contacted by phone (snowball sampling). However, for fishers, we had had previous access to a list of fishers working in the area. For that case we selected every 5th person in the list, who was then invited by phone to participate in the focus group sessions. For those cases in which the contacted fisher was not available to participate in the focus group session, we contacted the next person on the list and followed the same procedure until a fisher was available to join the focus group.

Data analysis

THEMATIC ANALYSIS

I transcribed the interviews and focus groups discussions to oTranscribe (Bentley, 2013) and uploaded the resulting documents to a text analysis software. After reading and getting familiar with all text transcripts, I coded the text using a thematic analysis approach (Braun and Clarke, 2006). Seven main categories of themes emerged from the data. These categories were conditioned by the theoretical framing I chose to analyse the data, that is social-ecological systems theory and ecosystem services concept. I categorised theme into “ecosystem service”, “well-being attribute”, “pressure”, “trend”, “proposal”, “negative opinion about MPA governance and management”, and “positive opinion about MPA governance and management”.

NETWORK ANALYSIS

I used a network approach to analyse and visualise the coded themes of the qualitative data generated by the interviews and focus group discussions (Pokorny et al., 2017). This method draws on graph theory and network analysis to quantify and visualise the relationships between codes used in transcripts. In this method a code is represented by a node. And an edge is represented by a relationship between two codes. This network analysis entails creating edges based on the chronological location of codes. This means that code "A" is connected to code "B" in the network if code "B" was created after code "A" in the interview or focus group discussion transcript. This data analysis approach was used before in education and psychology studies (Bodin, 2012; Pokorny et al., 2017). Instead of relying in the analyst's interpretation of relations between codes in a text, this method has the advantage of using predefined criteria—that is chronological order—to create networks. This approach increases reproducibility because it allows other researchers to reproduce network metrics from the same set of code data (Pokorny et al., 2017).

Here edges are either directed or bidirectional, indicating a one-way or two-way relationship between two codes. Edges are directed if two codes are subsequent, and bidirectional if codes overlap the same portion of transcript text. Edges, or relationships, were also weighted. I gave a weight of "1" to codes arising from implicit statements, and a weight of "2" to codes signalling explicit assertions. This weighting approach was an adaptation of the approach used by Carley and Palmquist (1992) to weight connections in mental model graphs. To avoid the weighting effect of verbose responses, I removed nodes' self-connections, that is connections between the same code.

To measure the relative importance and influence of each node in the graphs, I calculated two measures of centrality: weighted degree and betweenness. In the graphs, node size corresponds to node's weighted degree. This network metric accounts for the number (degree) and strength (weight) of the edges directed toward and going out of a node (Newman, 2010). I applied a similar rationale to edges. Edges

thickness is proportional to edge's weight to represent their relative importance in the graphs. Betweenness centrality is a slightly different way of determining the importance of a node in the network. It measures the number of links a node makes with other nodes that are otherwise unlinked. A node placed between many important nodes in the network has high betweenness centrality, acting as a bridge between important nodes (Newman, 2010). In this context, important nodes are those with high weighted degree.

Besides the number of nodes and edges, I computed the diameter, average path length, and graph density to measure the networks' size. The diameter is simply the longest path between two nodes. Average path length is the average number of edges necessary to connect two nodes selected by chance (Pokorny et al., 2017). As a result, the minimum path length value is 0 and the maximum is the diameter of the network. Network density represents the proportion of edges per node out of the total number of edges. A highly interconnected network would have a density close to 1 and a sparse network a density close to 0 (Pokorny et al., 2017).

For an easier interpretation of the graphs I assigned a different colour to each of the seven coded themes. I did all graphs and network metrics' calculations in Gephi 0.9.2. (Bastian et al., 2009). To visualise graphs, I used the Fruchterman-Reingold algorithm, a force-directed layout algorithm (Fruchterman and Reingold, 1991).

Results

Coding of interviews and focus group transcripts generated 726 themes. Among these themes, I categorised 140 as "ecosystem services", 124 as "well-being attributes", 161 as "opinions about MPA governance and management", 108 as "pressures", 103 as "trends", and 90 as "stakeholders' suggestions of MPA management actions". Themes overlapped within and across interviews and focus group transcripts.

The network with the highest number of nodes (hereafter, themes) is the fishers' network, with 80 themes (**Table 5**). Fishers' network has also the highest number of edges and connections per theme, that is the highest average weighted degree. This means that interviews and focus group discussion with fishers generated the widest diversity of interrelated themes. The networks of maritime tourism operators, scientists, and MPA managers connect between 60 and 64 nodes to 120 to 135 edges. The maritime tourism operators' network shows the highest average betweenness centrality (276.60), meaning that, on average, the group's interviews and focus groups discussions generated themes connected to the largest number of otherwise unlinked themes in the network. The least number of nodes and edges belongs to the fish vendors' network. Yet this network is the most interconnected due to its lowest average path length and higher density, having less, but more repeatedly, joint themes than the other networks. But overall the five networks are sparsely interconnected because they have relatively few edges per node, as indicated by the low—close to 0—density values. These findings suggest that interviewees discussed a wide range of different themes without much overlap. In the next sections I present in detail the main themes brought up by stakeholders during interviews and focus group discussions.

Table 5. Summary of network metrics of fishers', fish vendors', maritime tourism operators', scientists', and MPA managers' networks.

Network metrics	Fishers	Fish vendors	Maritime tourism operators	Scientists	MPA managers
Nodes (N)	80	29	61	64	60
Edges (N)	256	88	127	120	135
Weighted degree ($\bar{x} \pm SE$)	8.91 ± 0.70	6.71 ± 0.88	7.30 ± 0.59	6.60 ± 0.62	7.86 ± 0.85
Weighted in-degree ($\bar{x} \pm SE$)	4.46 ± 0.36	3.36 ± 0.48	3.65 ± 0.30	3.30 ± 0.31	3.93 ± 0.42
Weighted out-degree ($\bar{x} \pm SE$)	4.46 ± 0.35	3.36 ± 0.46	3.65 ± 0.30	3.30 ± 0.31	3.93 ± 0.44
Betweenness ($\bar{x} \pm SE$)	258.48 ± 32.56	86.00 ± 17.05	276.60 ± 31.89	243.25 ± 35.86	185.61 ± 24.65
Diameter	10	12	14	11	13
Path Length ($\bar{x}$)	4.31	4.19	5.69	4.92	4.63
Density	0.029	0.071	0.029	0.029	0.036

Opinions about Litoral Norte MPA governance and management

I found a mismatch between MPA managers' perceptions and those of the other stakeholder groups. Besides managers, all groups generated themes associated more with negative than positive opinions about local MPA governance and management (**Figure 6**). Fishers' and scientists' networks show the highest number of central themes associated with negative opinions (**Figure 5; Figure 7**). For example, interviewed

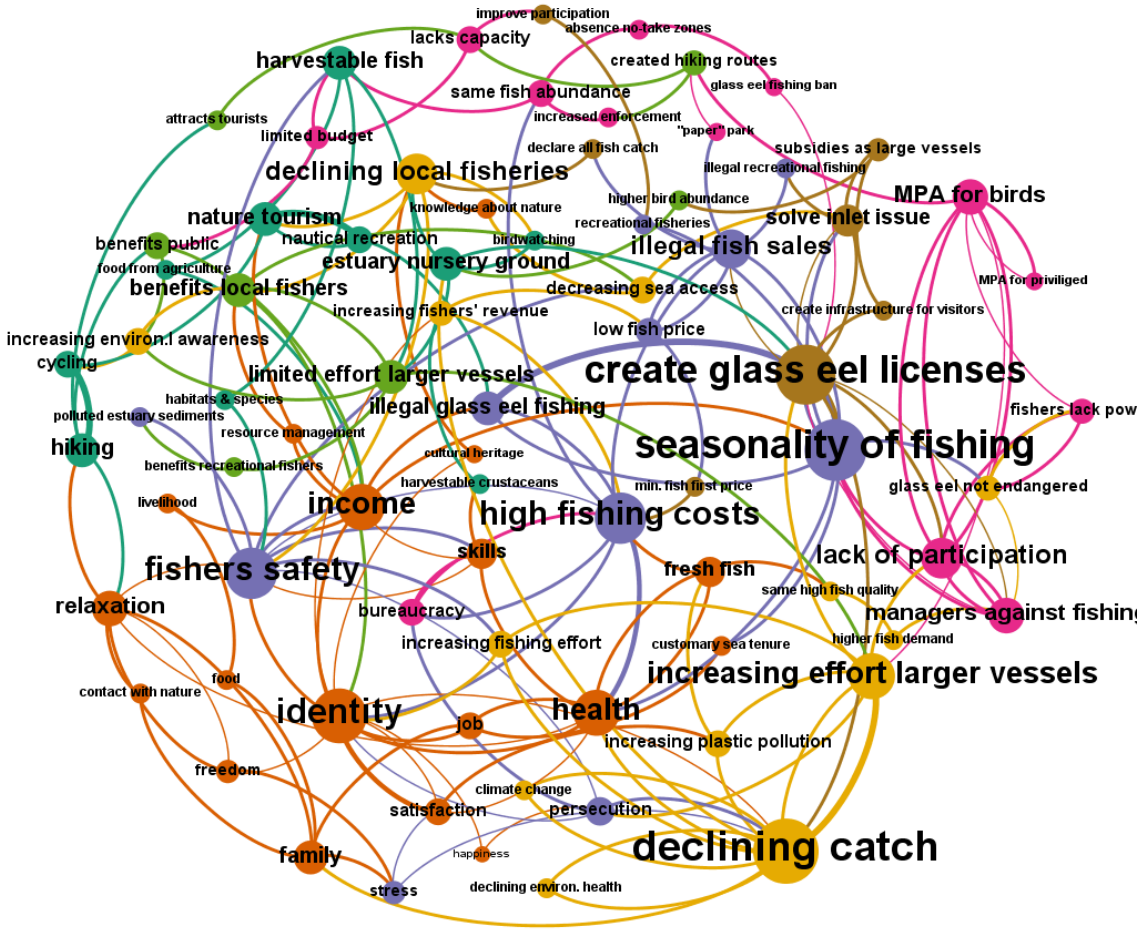

Figure 5. Fishers' network with themes from semi-structured interviews and focus group discussions. Themes are classified by category: ecosystem services (dark green); well-being attributes (orange); positive (light green) and negative (pink) opinions of MPA governance and management; trends (yellow) since the designation of the MPA; pressures (purple) occurring in the area; and suggestions (brown) of MPA management actions.

fishers reported a "lack of participation" in MPA's decisions (weighted degree [wd] = 16, betweenness centrality [b] = 295). Fishers revealed they were not properly heard before the creation of the MPA and stated that public hearings organised by MPA

managers during the implementation phase happened only to comply with formal obligations. For example, one fisher said:

> *"Most people heard what they had to say but that was already written. The public consultation existed but only for a few people and institutions. It was not for the fishermen."* [Focus group A – fishers]

In the fishers' network the theme "lack of participation" links to other themes associated with negative opinions such as "MPA for birds" (wd = 13, b = 418), "managers against fishing" (wd = 13, b = 313) and "fishers lack power" (wd = 7, b = 23). Likewise, in the fish vendors' network (**Figure 9**), "lack of participation" (wd = 4, b = 0) links to "managers against fishing" (wd = 5, b = 120), which then connects to "MPA for birds" (wd = 4, b = 117). Both stakeholder groups argued that managers are against fishing inside the MPA and support the prohibition of fishing in the future. To illustrate this claim, one fisher stated:

> *"And that's what's going to happen [fishing prohibition inside the park], as far as I'm concerned. If it's not for us, it's going to be for the next fishermen. When they [MPA managers] act out there and say that it's forbidden to fish there (...). If this comes along then it ends up with the local fishermen, there is no doubt."* [Focus group A – fishers]

Both interviewed scientists and fishers perceived "same fish abundance" inside the MPA (wd = 10, b = 392; wd = 8, b = 337; respectively) when compared to fish abundance prior the establishment of the MPA. In the scientists' network this theme is links to "limited enforcement" (wd = 10, b = 498) while in the fishers' network it connects to "absence no-take zones" (wd = 4, b = 144).

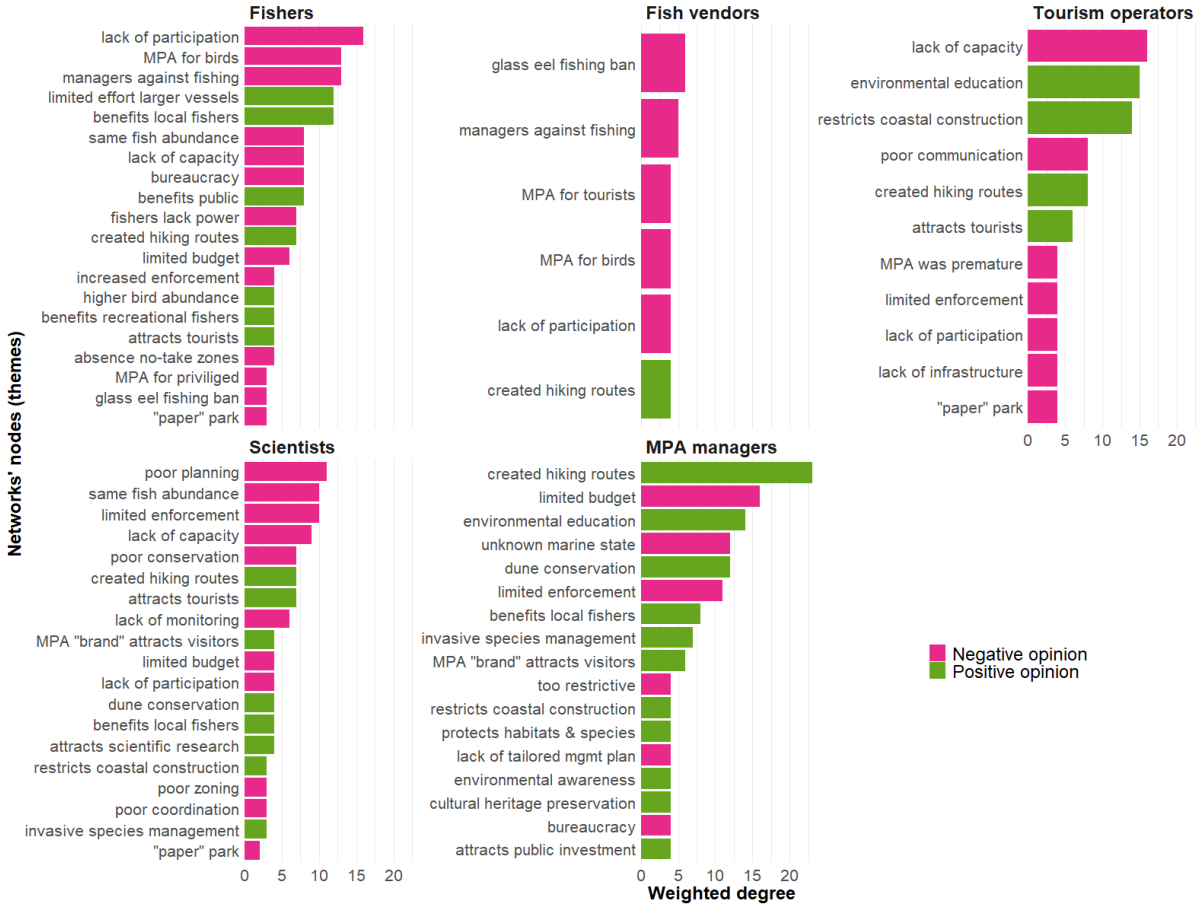

Figure 6. Relative importance (weighted degree) of all themes associated with positive (green) and negative opinions (pink) of MPA local governance and management. Bar plots show themes of five networks: fishers, fish vendors, tourism operators, scientists, and MPA managers.

Other central themes conveying negative opinions in the scientists' network are "poor planning" (wd = 11, b = 553) linked to "lack of participation" (wd = 4, b = 174). Similarly, "lack of capacity" (wd = 9, b = 471) connects to "lack of monitoring" (wd = 6, b = 375) and "poor coordination" (wd = 3, b = 61). On MPA planning and coordination, one scientist revealed:

> *"The [MPA] Strategic Council, for all intents and purposes, needs to provide an evaluation of the annual work plans and activity reports. There were only two meetings over these years [10 years]. Only one work plan was analysed*

and only one activity report was analysed. Both were poor." [ID 4 – scientist]

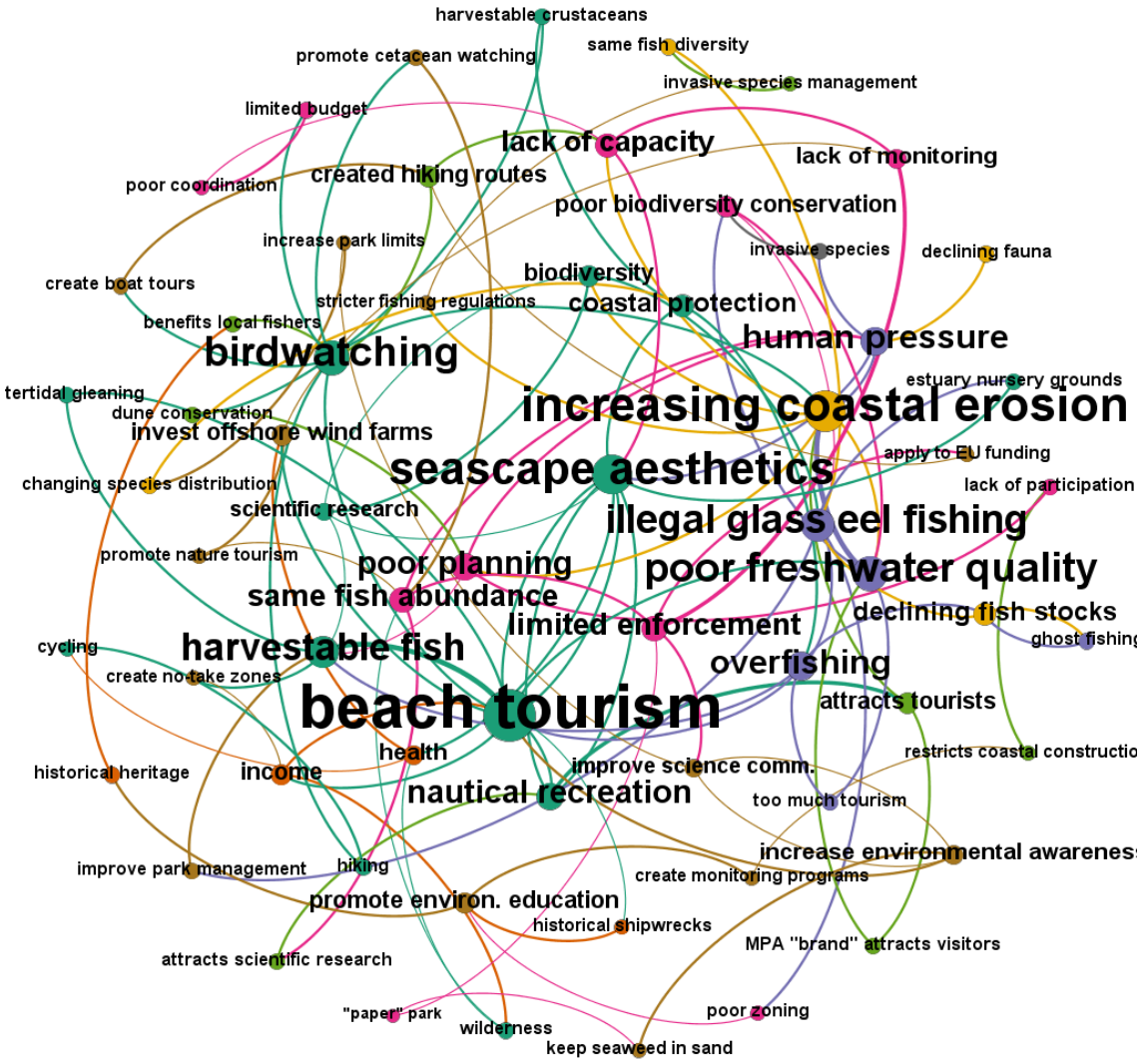

Figure 7. Scientists' network with themes from semi-structured interviews. Themes are classified by category: ecosystem services (dark green); well-being attributes (orange); positive (light green) and negative (pink) opinions of MPA governance and management; trends (yellow) since the designation of the MPA; pressures (purple) occurring in the area; and suggestions (brown) of MPA management actions.

There are similar themes in the maritime tourism operators' network (**Figure 8**). The central theme conveying a negative opinion is "lack of capacity" (wd = 16, b = 1,183). This theme links to "limited enforcement" (wd = 4, b = 231) and "MPA was premature" (wd = 4, b = 214). In fact, interviewed tourism operators focused their opinions on the lack of a clear plan, vision, and appropriate management by MPA managers. They argued that the MPA was a "paper park" and was premature because

managers were still doing a species inventory 10 years after the creation of the MPA. They stated that the MPA lacked "presence" in the field and claimed that managers did not have a clear communication strategy to the public about MPA limits, zoning and usage restrictions. During a focus group discussion, a maritime tourism operator noted:

> *"[Part of the municipality of] Esposende is classified as a natural park, but the park practically does not exist. They [MPA managers] are still making an inventory of the species that exist. One goes there to the rocks, lifts a rock, and discovers a species that the park doesn't know it existed. So the park was very premature. It's not a park yet..."* [Focus group C – maritime tourism operators]

In the same focus group session, other tourism operator argued:

> *"In any natural park out there everything is marked, everything is sign-posted. There are rules for each space, there are spaces for people to use and how they should use them. Things have been thought out. There's nothing here. There is absolutely nothing."* [Focus group C – maritime tourism operators]

Interviewed MPA managers also criticised a few aspects of MPA management. The main issue was "limited budget" (wd = 16, b = 307). In their network (**Figure 10**) this theme connects to "unknown marine state" (wd = 12, b = 130), "limited enforcement" (wd = 11, b = 110) and "bureaucracy" (wd = 4, b = 20). To illustrate these connections, one MPA manager revealed:

> *"The knowledge that we have [of the state of marine ecosystems] is not great (…) We have a partnership with the Marine Ecology Forum which gives us some feedback and does diving activities because we do not have a boat to do diving activities."* [ID 2 – MPA manager]

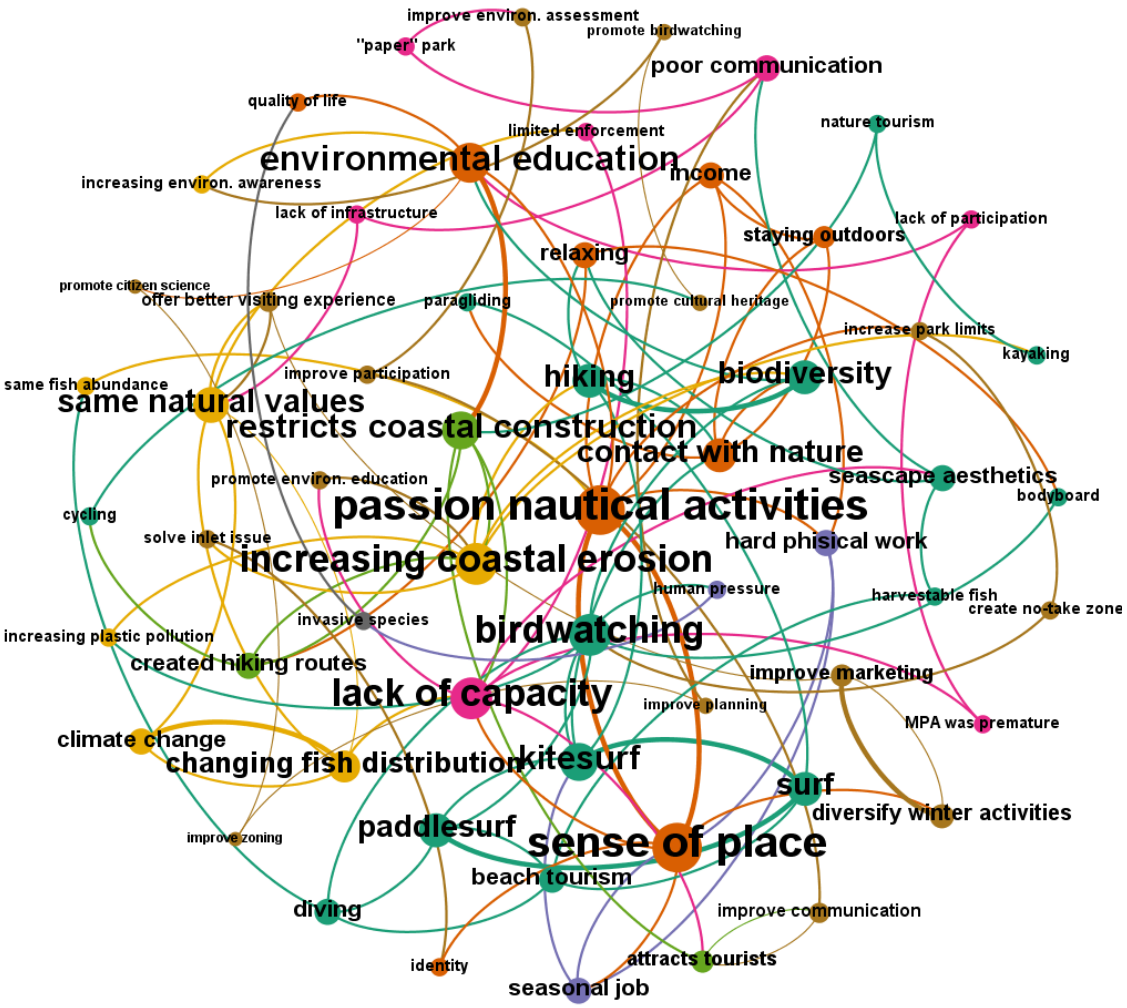

Figure 8. Maritime tourism operators' network with themes from semi-structured interviews and focus group discussions. Themes are classified by category: ecosystem services (dark green); well-being attributes (orange); positive (light green) and negative (pink) opinions of MPA governance and management; trends (yellow) since the designation of the MPA; pressures (purple) occurring in the area; and suggestions (brown) of MPA management actions.

Not all opinions about the MPA were negative among interviewees and focus group participants. For example, all groups referred positively to the hiking routes created after the creation of the MPA, which included wooden walkways to protect dunes and estuary margins from trampling. Another positive aspect mentioned by several groups were the restrictions brought up by the creaion of the MPA that halted housing and other infrastructure construction on the coastline. Groups also considered positive the ways MPA managers have been spreading environmental education among the public. Also, on a positive side, interviewed managers highlighted that the MPA "benefits local fishers" (wd = 8, b = 73). In their network this theme links to "cultural

heritage preservation" (wd = 4, b = 0) and to the ecosystem services "harvestable fish" (wd = 24, b = 586) and "beach tourism" (wd = 24, b = 612). These connections emphasise perceived fisheries contributions to local culture. Connections further suggest that managers perceive that the MPA can increase supply (harvestable fish) and demand (beach tourism) for fish in the area, thus benefitting local fishers. Both managers and maritime tourism operators emphasised the importance of the MPA to attract tourists. According to them, the MPA works as a "brand" in the region. Tourism operators said the park was "good for tourism" and hence good for their nature-related activities. For example, one tourism operator said:

> *"I think the best thing that could have happened to Esposende [the municipality], namely for tourism operators, was the creation of a natural park."*
>
> [Focus group C – maritime tourism operators]

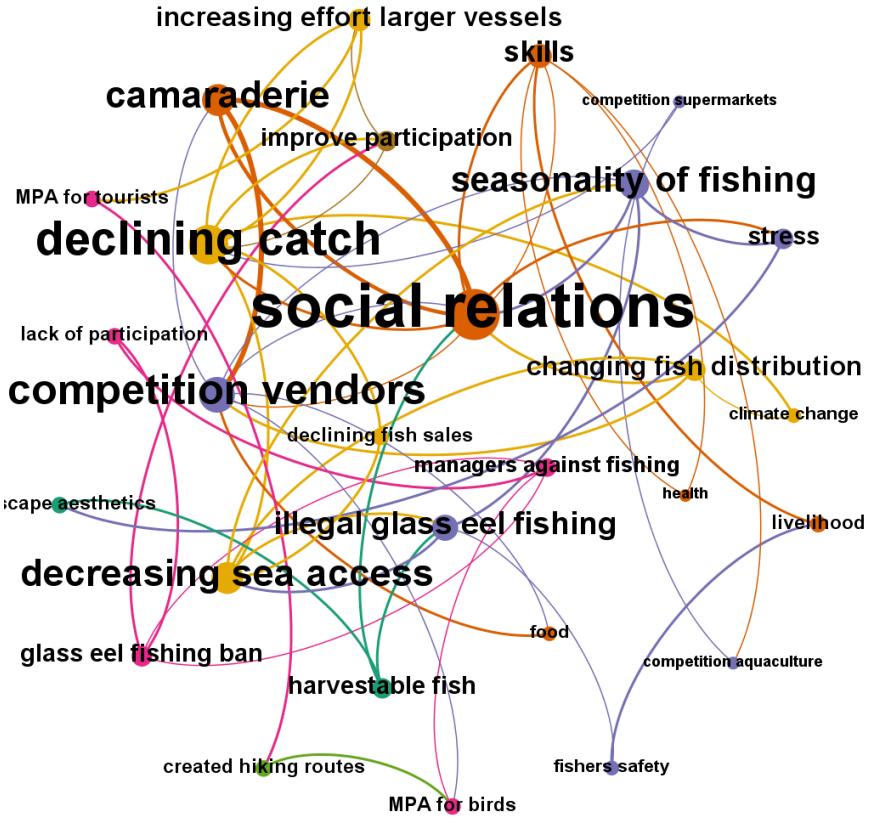

Figure 9. Fish vendors' network with themes from semi-structured interviews and focus group discussions. Themes are classified by category: ecosystem services (dark green); well-being attributes (orange); positive (light green) and negative (pink) opinions of MPA governance and management; trends (yellow) since the designation of the MPA; pressures (purple) occurring in the area; and suggestions (brown) of MPA management actions.

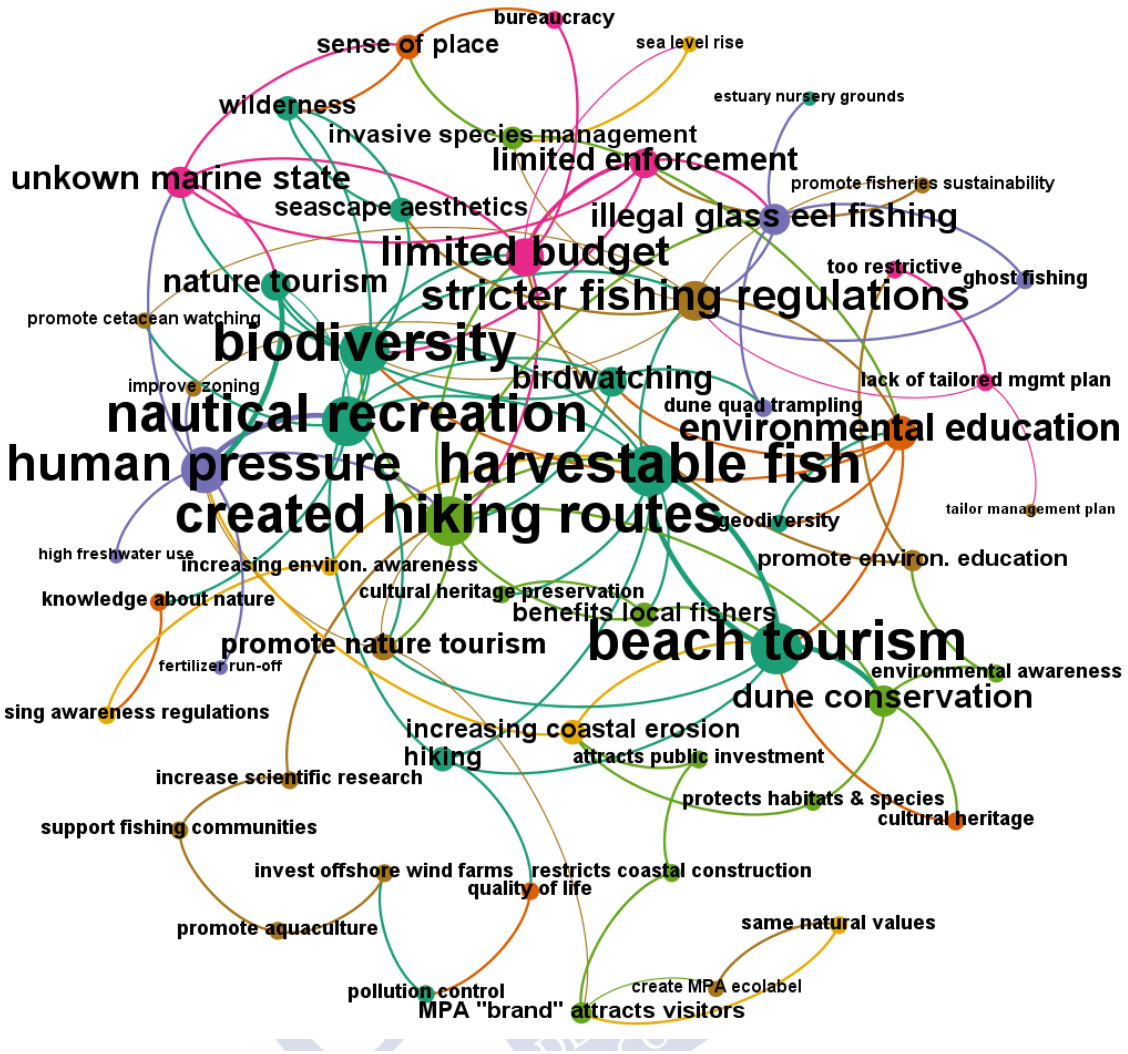

Figure 10. MPA managers' network with themes from semi-structured interviews. Themes are classified by category: ecosystem services (dark green); well-being attributes (orange); positive (light green) and negative (pink) opinions of MPA governance and management; trends (yellow) since the designation of the MPA; pressures (purple) occurring in the area; and suggestions (brown) of MPA management actions.

Perceived ecosystem services and associated well-being attributes

Interviewed fishers perceived a wide diversity of well-being attributes about their fishing activity (**Figure 5**; **Figure 11**). Among the themes representing well-being attributes, "identity" is the most important in the fishers' network (wd = 24, b = 1,111). Fishers strongly associated living off the sea as part of their identity. In fact, one fisher evoked childhood memories about the first time he went into a boat:

"I've been going [fishing] a lot since I was little. I used to run away from school to see fishers up there from the wall. When I was eight years old, I threw myself into the water and his father-in-law told my father—'take the boy, take the boy!'—I didn't even know if I could swim... Then he grabbed me and put me inside the boat and took me to the sea." [Focus group A – fishers]

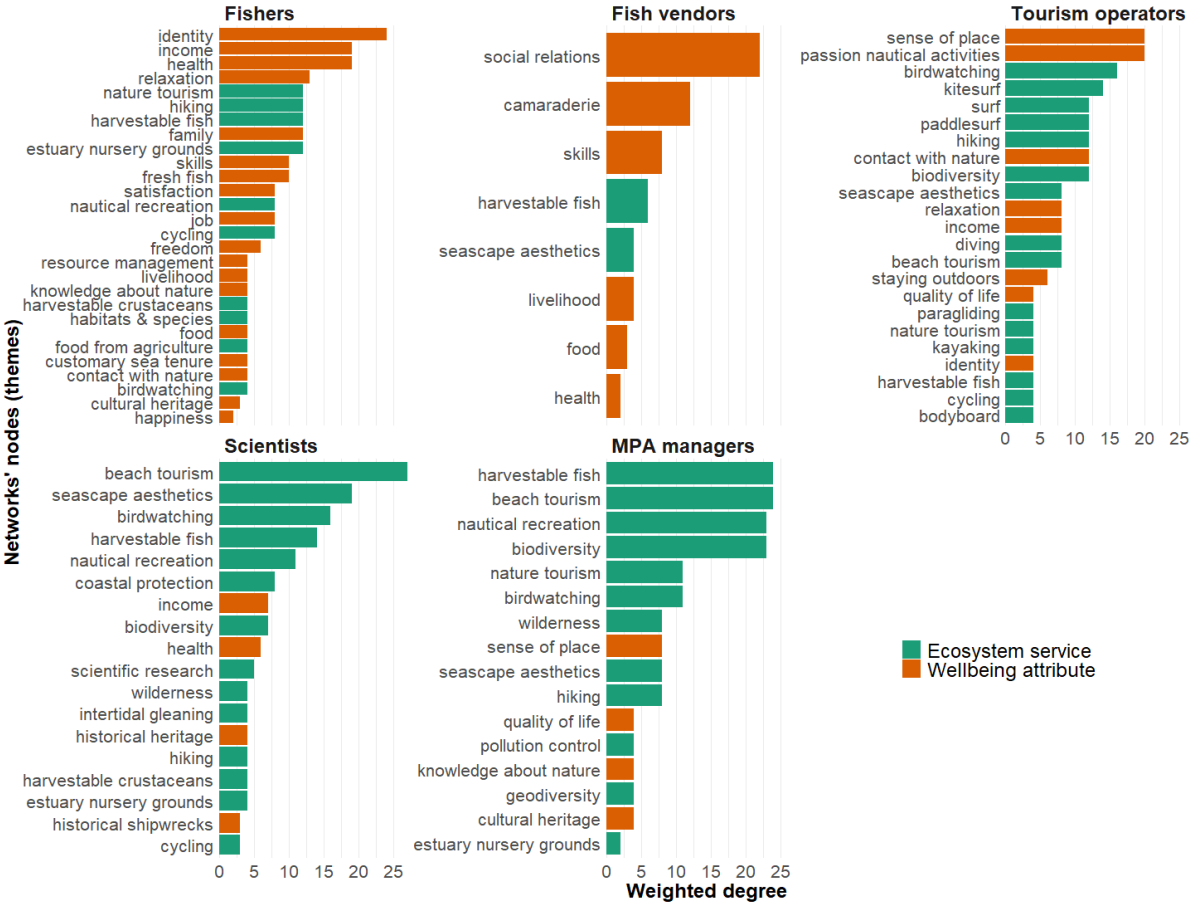

Figure 11. Relative importance (weighted degree) of all themes associated with ecosystem services (green) and human well-being attributes (orange). Bar plots show themes of five networks: fishers, fish vendors, tourism operators, scientists, and MPA managers.

In the fishers' network, "identity" is surrounded by other themes representing well-being attributes such as "health" (wd = 19, b = 789), "income" (wd = 19, b = 740), "relaxation" (wd = 13, b = 496), "job" (wd = 8, b = 190), "satisfaction" (wd = 8, b = 56), "freedom" (wd = 6, b = 75) and "happiness" (wd = 2, b = 10). These relationships highlight the intertwined nature of well-being attributes that fishers derive from the sea and their fishing activity.

Besides "harvestable fish" (wd = 12, b = 406) there are other themes representing ecosystem services in the fishers' network. Some of these themes are "estuary nursery grounds" (wd = 12, b = 580) and "habitats & species" (wd = 4, b = 82), which are supporting and regulating ecosystem services associated with fisheries. "Nature tourism" (wd = 12, b = 206), "hiking" (wd = 12, b = 369) and "nautical recreation" (wd = 8, b = 51) are other important locally provided ecosystem services perceived by fishers.

Although interviews and focus group discussions with fish vendors generated less themes than other groups, they shed light on what is important for interviewed fish vendors (**Figure 11**). This group emphasised the social aspects of their fish sales, as evidenced by the importance of the node "social relations" in their network (wd = 22, b = 364). Social relations are shaped both through bonds fish vendors establish with regular clients and through "camaraderie" (wd = 12, b = 0) among fish vendors, as depicted in **Figure 9**. To illustrate this, one fish vendor revealed:

> *"They [the clients] come here and it's a family, it's a joy. If you come here on a Sunday, you'll feel the joy around here (…) They are great! Sometimes they do not even come to buy. Sometimes they come just to listen to us, to talk to us."* [Focus group B – fish vendors]

Another fish vendor stated:

> *"We go to the market to sell, or here, and in the market I help who is my colleague. As she well knows we help each other."* [Focus group B – fish vendors]

Besides "social relations", fish vendors spoke about the pride they have in their "skills" (wd = 8, b = 146) that allows them to do a well-done job. According to them these skills entail selecting, scaling and filleting high quality and mostly locally caught fish. Fish vendors emphasised also the importance of their fish for feeding nutritious food to people who live in the municipality. In their network, themes representing ecosystem services such as "harvestable fish" (wd = 6, b = 26) and "seascape aesthetics" (wd = 4, b = 26) do not only link to one another but also connect to the well-being

attribute “social relations”. These connections show the interrelated nature of ecosystem services bundles and human well-being.

In the tourism operators’ network, “sense of place” (wd = 20, b = 510) and “passion nautical activities” (wd = 20, b = 587) are the most important well-being themes (**Figure 8**; **Figure 11**). These themes link to one another and to “environmental education” (wd = 15, pr = 1,013) and “income” (wd = 8, pr = 47). One tourism operator explained these linkages during a focus groups discussion:

> *“Kitesurfing became a passion, which later became a business, and extended to several other passions for the sea. And we began to diversify our offer. It's not just about income. If it was only for the income, I’d do other things. I’d make more money than what I get from what I do here. It’s also a passion for the place, for the people, for all this. It's a set of situations… Incidentally, I've had other businesses in other places and at the moment we are closing them all and keep this only because it’s where we like to be and try to diversify our offer to really be able to live from it.”* [Focus group C – maritime tourism operators]

Other important well-being attribute in the tourism operators’ network is “contact with nature” (wd = 12, b = 205). This theme links not only to “staying outdoors” (wd = 6, b = 30)—a well-being attribute—but also to several ecosystem services such as “kitesurf” (wd = 14, b = 383), “hiking” (wd = 12, b = 430), “biodiversity” (wd = 12, b = 424) and “paragliding” (wd = 4, b = 15). One tourism operator revealed:

> *“[The positive aspect of this work is that] we are at the beach. I think it's a positive first thing. The outdoors is a plus. What other positive aspects? Contact with nature, all these are aspects that, for me, are positive.”* [Focus group C – maritime tourism operators]

Interviewed tourism operators highlighted the suitable conditions that both the estuary and the sea provide to tourism and outdoor recreational activities. For example, the Cávado estuary was often mentioned as a “unique” place to teach kitesurfing to new practitioners. The estuary, coastal waters, and associated MPA “seascape

aesthetics" (wd = 8, b = 654) were considered important by tourism operators to their nature-related business activities. One operator admitted that they "benefit from having an area with these seascape characteristics". Another said:

> *"Our dives are quite like those of Viana do Castelo [nearby municipality], with the advantage that here it's a bit wilder. One takes a boat trip from the north or the south, and clearly notes that entering this area (…) there are fewer houses on the coast. It's emptier. It has a larger natural component."*
>
> [Focus group C – maritime tourism operators]

Interviewed scientists focused more on the ecosystem services provided in the MPA than on well-being (**Figure 7**; **Figure 11**), contrary to fishers, fish vendors, and to some extent tourist operators. This is shown in the scientists' network, which is dominated by interrelated themes representing ecosystem services such as "beach tourism" (wd = 27, b = 1,608), "seascape aesthetics" (wd = 19, b = 994), "birdwatching" (wd = 16, b = 851), "harvestable fish" (wd = 14, b = 454), "nautical recreation" (wd = 11, b = 192), "coastal protection" (wd = 8, b = 341), "biodiversity" (wd = 7, pr = 222), "scientific research" (wd = 5, b = 123) and so on. But there are also a few themes representing well-being attributes. These are "income" (wd = 7, b = 155)—which links to both "beach tourism" and "wilderness" (wd = 4, b = 62); "health" (wd = 6, b = 170) linked to "seascape aesthetics", "cycling" (wd = 3, b = 95) and "wilderness"; and "historical heritage" (wd = 4, b = 177) and "historical shipwrecks" (wd = 3, b = 247), which represent the cultural and historical heritage derived from local maritime history, and from knowledge of underwater archaeological sites.

Like scientists, interviewed MPA managers highlighted more the ecosystem services provided in the MPA than well-being benefits. Among MPA managers' themes, three quarters are related to ecosystem services and one quarter to well-being attributes (**Figure 10**). Important ecosystem services in the network include "harvestable fish" (wd = 24, b = 586), "beach tourism" (wd = 24, b = 612), "nautical recreation" (wd = 23, b = 476), and "biodiversity" (wd = 23, b = 531). These themes interlink, suggesting that interviewed managers perceive the bundled nature of ecosystem service

provision in the MPA. Although less important than ecosystem services in their network, managers acknowledge the importance of well-being benefits provided by the area. They recognise the importance of "sense of place" (wd = 8, pr = 86), "quality of life" (wd = 4, b = 245), "knowledge about nature" (wd = 4, b = 101) and "cultural heritage" (wd = 4, b = 0).

Perceived pressures and trends since the creation of the MPA

When asked about the main trends related with their professional activities since the creation of the MPA in 2008, both fishers and fish vendors reported declining fish catch. During a focus group discussion, one fisher recalled:

> *"I used to fill the boat with seabass, it was every day! (…) I know there are days when I catch seabass, I can say that I caught it the other day. But what about those days when I don't catch? Before it used to be every time."* [Focus group A – fishers]

During the fish vendors' focus group session, one participant admitted:

> *"There is less fish than a few years ago. There used to be so much more."*
> [Focus group B – fish vendors]

"Declining catch" (wd = 30, b = 1,108) is the most important theme in the fishers' network (**Figure 12**). This theme links to others themes representing trends such as "increasing effort larger vessels" (wd = 15, b = 602), "increasing fishing effort" (wd = 8, b = 89), "increasing plastic pollution" (wd = 8, b = 70), "declining environmental health2 (wd = 4, b = 0), and "climate change" (wd = 4, b = 0). Declining catch is also linked to themes representing social pressures such as "stress" (wd = 6, b = 121) and "persecution" (wd = 9, b = 265) by police authorities. At the same time, declining catch connects to themes denoting well-being attributes such as "identity" (wd = 24, b = 1,111), "health" (wd = 19, b = 789) and "family" (wd = 12, b = 328). These interlinkages between trends, pressures and well-being attributes highlight the complexity and

associated ramifications of perceived negative ecological outcomes by local resource users.

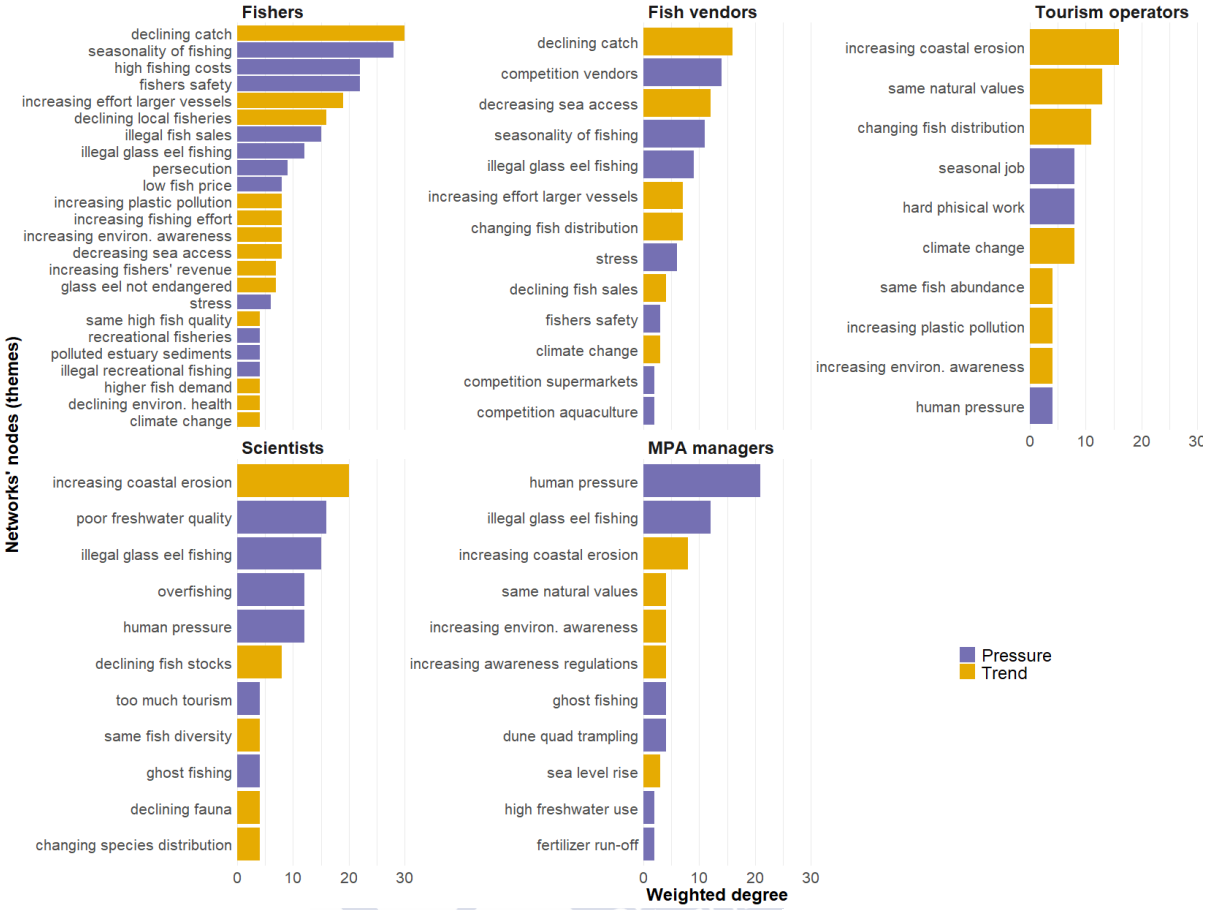

Figure 12. Relative importance (weighted degree) of all themes associated with trends (yellow) since the creation of the MPA, and pressures (purple) occurring in the area. Bar plots show themes of five networks: fishers, fish vendors, tourism operators, scientists, and MPA managers.

Similar results are shown for fish vendors. In their network, "declining catch" (wd = 16, b = 324) is also the most important theme among those representing trends, connecting to "decreasing sea access" (wd = 12, b = 187), "increasing effort larger vessels" (wd = 7, b = 62), "declining fish sales" (wd = 4, b = 0), and "climate change" (wd = 3, b = 57). The theme also links to "social relations"—a central well-being theme—and "improve participation" (wd = 6, b = 138), which is a theme representing a proposal made by fish vendors to improve MPA local governance and management (**Figure 5**). These results show that fish vendors relate their perceived negative trend of declining fish catch to different phenomena and suggest improved participation to help tackling the negative trend.

Other important theme both in fishers' and fish vendors' networks is "seasonality of fishing" (wd = 26, b = 1,019; wd = 9, b = 100; respectively). It concerns the weeks—mostly in winter—in which fishers cannot go out fishing due to rough sea and weather conditions. Several interviewed fishers argued that they would spend less time on land were the inlet at the mouth of the Cávado estuary be dragged and "fixed". The mouth of the estuary gives them access to the sea. Fishers considered the inlet dangerous and mentioned accidents that had occurred recently in the area. In their network, the theme "seasonality of fishing" connects to "solve inlet issue" (wd = 11, b = 250). It also connects to well-being attributes such as "income" and "health". "Seasonality of fishing" links also to other themes of social-ecological pressures such as "illegal glass eel fishing" (wd = 12, b = 253) and "illegal fish sales" (wd = 15, b = 616). Glass eel fishing in the Cávado estuary—a forbidden activity—is rather profitable because eels are highly demanded in Asian markets. Selling glass eels is an income complement for fishers during winter months when they hardly go to the sea. It is thus not surprising that "seasonality of fishing" also links to "create glass eel licenses" (wd = 27, b = 1,108)—one of the most important themes in the fishers' network. During a focus groups discussion, one fisher suggested:

> *"This illegal [glass eel] fishing has many intruders, hasn't it? It's known that it goes on from north to south, and the State could gain from it. There could be a temporary closure that would make it all better. In the end, if we were licensed, it would improve everything. There wouldn't be so many intruders in this fishery. There would be taxes paid by fishermen, for the future of them to be better, to improve their pensions and everything. It would be much better for everyone, for everything."* [Focus group A – fishers]

Yet glass eel fishing is a rather contentious issue in the MPA, having resulted in fines and arrests recently. Glass eel is the juvenile stage of the IUCN's critically endangered European eel (*Anguilla anguilla*), a protected species. Similar theme connections related with glass eel fishing are shown in the fish vendors' network (**Figure 9**).

Interviewed tourism operators and scientists also perceived changes in MPA's fish populations. For example, in the tourism operators´ network, the theme "changing fish distribution" (wd = 11, b = 289) links not only to "climate change" (wd = 8, b = 0), but also to a theme representing a negative opinion about MPA management: "lack of capacity" (wd = 16, b = 1,183). Other related theme – "same fish abundance" (wd = 4, b = 81) – connects to "diving" (wd = 8, b = 167), conveying the perception of local recreational divers about the trend of fish abundance since the creation of the MPA in 2008.

Scientists perceive "declining fish stocks" (wd = 8, b = 142), "same fish diversity" (wd = 4, b = 121), "declining fauna" (wd = 4, b = 61), and "changing species distribution" (wd = 4, b = 82) since the creation of the MPA. In their network, "declining fish stocks" links to "illegal glass eel fishing" (wd = 15, b = 614), "overfishing" (wd = 12, b = 627), and "ghost fishing" (wd = 4, b = 0), which represents lost fishing gear at sea that causes continued fish mortality. These linkages show that interviewed scientists associate declining fish stocks with fisheries occurring inside the MPA.

"Increasing coastal erosion" is the most important theme of those representing trends in the networks of MPA managers, scientists, and tourism operators. In the managers' network, "increasing coastal erosion" (wd = 8, b = 318) associates with "human pressure" (wd = 21, b = 343) and "beach tourism" (wd = 24, b = 612). Likewise, interviewed scientists link "increasing coastal erosion" (wd = 20, b = 973) to "human pressure" (wd = 10, b = 517). The theme connects to other themes related with negative opinions about MPA management such as "poor planning" (wd = 11, b = 553) and "lack of capacity" (wd = 9, b = 471). In the tourism operators' network, "increasing coastal erosion" (wd = 16, b = 891) is associated with several themes representing proposals for MPA improvement (**Figure 13**) such as "solve inlet issue" (wd = 4, b = 178) and "promote environmental education" (wd = 4, b = 231). Coastal erosion is a complex phenomenon in the area, with a broad set of potential causes and pathways for mitigation, as evidenced by the perceptions of interviewees and focus groups participants.

Articulating perceptions: stakeholders' suggestions of MPA management actions

During interviews and focus groups discussions we asked stakeholders to articulate their perceptions into suggestions to help improve MPA management (**Figure 13**). A few of these suggestions contradict one another. For example, while fishers propose the "creation of glass eel fishing licenses" (wd = 27, b = 1,108), managers and scientists support "stricter fishing regulations" (wd = 3, b = 121; wd = , b = ; respectively). Similarly, within managers' suggestions, while some propose "stricter fishing regulations" (wd = 17, b = 560), others argue for the "support fishing communities" (wd = 4, b = 253). Yet, many suggestions are common among groups. Local resource users—that is fishers, fish vendors, and tourism operators—all call for improved participation in MPA decisions. To this end, one fish vendor stated:

> *"They [MPA managers] should arrange meetings with the fishermen, should try to understand their side, what is right and what is wrong. Because fishermen, in certain things, whether they like it or not, know better than they do."* [Focus group B – fish vendors]

Both fishers and tourism operators claim that managers should "solve the inlet issue" (wd = 11, b = 250; wd = 4, b = 178; respectively) to improve navigation safety when vessels go to the sea. Common suggestions among tourism operators and scientists are to "increase park limits" (wd = 4, b = 167; wd = 3, b = 82; respectively) and to "create no-take zones" (wd = 4, b = 167; wd = 3, b = 23; respectively). In the scientists' network, the theme "increase park limits" connects to the trend "changing species distribution", while "create no-take zones" links to "harvestable fish" and "income". These connections suggest that scientists associate stricter regulations and increased MPA size with improvements of ecosystem services provision and human well-being.

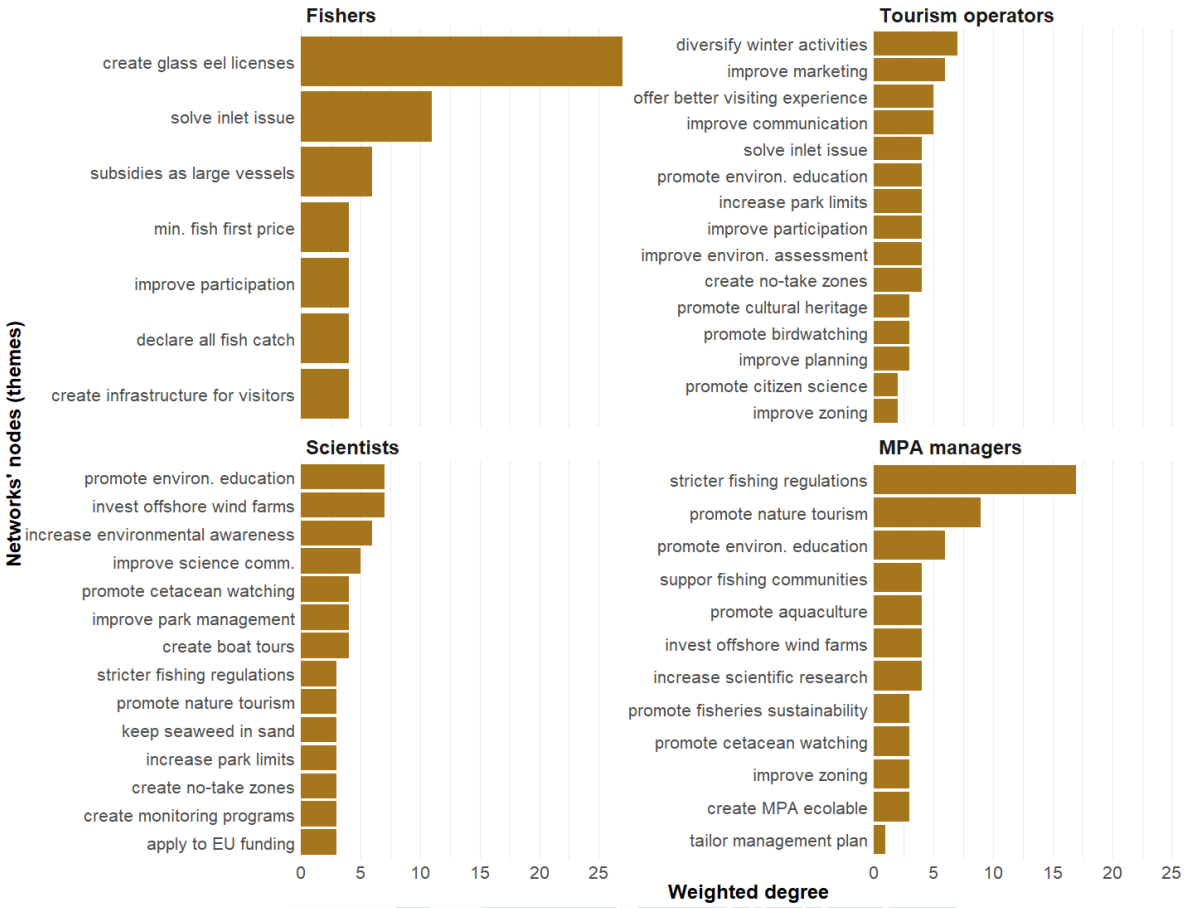

Figure 13. Relative importance (weighted degree) of all themes associated with stakeholders' suggestions of MPA management actions. Bar plots show fishers', tourism operators', scientists', and MPA managers' network themes. Results of fish vendors are omitted as their network had only one observation of this category (i.e., 'improve participation', with a weighted degree of 6).

Interviewed tourism operators suggested that MPA environmental assessments should be improved (wd = 4, b = 130). They argued that baseline scientific knowledge is where managers should concentrate efforts first. And that knowledge should be produced about the abundance, richness, and state of species in the area. Then planning (wd = 3, b = 165), zoning (wd = 2, b = 165), and restricted and allowed uses for each zone should be well thought to align with MPA's goals for biodiversity conservation. Moreover, tourism operators proposed that the MPA should have more presence in the field, with more and better signposts along with more MPA officers monitoring and patrolling the area. The group proposed that infrastructure for MPA users should be put in place to enhance visiting experience (wd = 5, b = 189) and to improve their

sea-related tourism activities. Improved communication (wd = 4, b = 178) among all stakeholders of the MPA was another suggestion of the group.

Interviewed MPA managers argued for multiple uses inside the MPA, as suggested by the themes “promote nature tourism” (wd = 9, b = 349), “support fishing industry” (wd = 4, b = 253), “promote aquaculture” (wd = 4, b = 251), “invest in offshore windfarms” (wd = 4, b = 249), “increase scientific research” (wd = 4, b = 255), “promote cetacean watching” (wd = 3, b = 11), and “create MPA ecolabel” (wd = 3, b = 51).

Discussion

The study of perceptions can help foster the legitimacy, acceptability and support for MPAs (Leleu et al., 2012; Bennett, 2016; Bennett et al., 2019). To test this claim, I set out to elicit the interlinkages of stakeholder’s perceptions of Litoral Norte MPA, using a network approach. Findings of this study indicate a clear mismatch between managers’ perceptions of MPA governance and management, and those of fishers, fish vendors, tourism operators, and scientists. While managers’ opinions about MPA governance and management tended to be positive, the opinions of the other stakeholder groups were frequently negative. For example, shared negative opinions were related with a lack of effective participation processes and a perceived lack of capacity of the MPA to generate positive social and ecological outcomes. Fishers and fish vendors generally believed that the Litoral Norte MPA was a tool against fishing and was created for the benefit of tourists and bird conservation. On the other hand, managers tended to emphasise successful initiatives such as the creation of coastal routes, environmental education, and habitat conservation. The mismatch between mostly positive perceptions by managers, on the one hand, and mostly negative perceptions of resource users’ and scientists’, on the other, is a concern for the future of Litoral Norte MPA.

This concern stems from the fact that positive perceptions of governance and management by local communities are often associated with MPA's positive outcomes (McNeill et al., 2018; Bennett et al., 2019).

Different groups, different perceptions

Stakeholder groups differed in their main concerns. While fish and fish vendors mostly worried with the local decline of fish catch, scientists and tourism operators identified increasing coastal erosion as the main challenge of the MPA. Yet the four groups shared negative opinions about MPA governance, which may indicate their lack of support for Litoral Norte MPA (Bennett, 2016). These perceptions may change in the future with effective governance and the delivery of positive social and ecological outcomes by the MPA (Leleu et al., 2012).

Effective governance requires institutional diversity (McCay and Jones, 2011), which combine bottom-up approaches—benefitting from detailed local knowledge—, and top-down institutions, which are better-suited for dealing with social-ecological interlinkages across temporal and spatial scales (Cudney-Bueno and Basurto, 2009). Positive ecological outcomes are usually contingent on MPA design, enforcement, staff and financial capacity (Edgar et al., 2014; Gill et al., 2017). Achieving positive social outcomes requires disaggregating stakeholder groups' perceptions to understand their needs, interests, and aspirations (Daw et al., 2011; Pita et al., 2013). Improving participation in MPA decisions—a suggestion made by fishers, fish vendors, and tourism operators—could help achieve positive social outcomes. Improved participation encourages compliance, legitimacy of decisions, trust, and decreased conflict (Andrade and Rhodes, 2012). But managers should be aware of participatory processes' drawbacks. These include relatively high time and financial costs, and unsatisfying experiences for participants if participatory processes are not properly planned or facilitated. Although important for improved decisions, participatory processes alone are not enough. They should go together with activities that empower and fully engage

stakeholders with conservation goals. Such activities can include capacity building, environmental education, and effective communication between managers, scientists and resource users (Pomeroy and Douvere, 2008).

Stakeholder groups' perceptions of ecosystem services and well-being attributes shared similarities but also differed in several aspects. Compared to scientists and managers, local resource users—that is fishers, fish vendors, and tourism operators—perceived a much wider diversity of both material and non-material well-being attributes associated with their sea-related activities. For example, fishers emphasised identity, income, and health. Fish vendors highlighted the social relations, camaraderie, and pride in their skills. Tourism operators stressed the importance of the contact with nature, sense of place, and passion for nautical activities. A broader set of perceived well-being benefits by local resource users may be the result of their higher dependence, closer experience, and deeper relationships with the marine environment (Cárcamo et al., 2014; De Vos et al., 2018). And because scientists and MPA managers do not depend directly on locally provided ecosystem services, nor belong to the social groups affected by the creation of the MPA. However, compared to fishers and fish vendors, scientists and managers did recognise a broader set of ecosystem services provided in the MPA, including beach tourism, seascape aesthetics, harvestable fish, nautical recreation, coastal protection, pollution control, and biodiversity. Perceptions about well-being and related ecosystem services may differ among stakeholders as a result of a complex set of factors including socioeconomic characteristics, needs, experiences, cultural traditions, sources of income, and access to power (Daw et al., 2011; Martín-López et al., 2012; Hicks et al., 2013).

Implications for conservation practice and policy

The findings of this study offer several insights for conservation practice and policy. First, understanding stakeholders' perceptions and opinions can shed light on the underlying causes that hinder social acceptability and support for conservation initiatives

(Jones et al., 2017; N. Jones et al., 2018). For example, while current MPA regulations do not impose strict fishing restrictions—fishers can inside the MPA as before—they impose and enforce a ban on the catch of the critically endangered glass eel in the Cávado estuary. These restrictions deter fishers' and fish vendors' from supporting the MPA. This happens because fishers see denied their access to glass eel fishing—one of their few sources of income during winter months when they stop going to the sea due to rough weather and sea conditions. While fishing a critically endangered species may not be ethically acceptable nor prudent for the sake of conservation, managers should openly and transparently recognise this source of conflict. Managers can see this conflict as an opportunity to co-develop with fishers and fish vendors alternative sources of income in the winter months. By targeting the underlying causes of negative perceptions, managers can help increase the social acceptability and local support for conservation (Bennett and Dearden, 2014).

Second, articulating stakeholders' perceptions can help identify promising management actions (Adams and Sandbrook, 2013; Yates et al., 2019). For example, fishers suggested that the conditions to access the sea via the estuary inlet should be improved. Besides improving safety conditions for fishers, this action may also help decreasing illegal glass eel fishing effort due to increased access to sea and more opportunities of marine fishing, instead of estuary fishing where glass eels are caught. In another suggestion, tourism operators recommended that managers should improve MPA marketing, promote citizen science, and increase communication with the local community. These actions can effectively engage local people in MPA-related activities and strengthen social networks that foster institutional and social trust—two factors known to improve perceived benefits and support for conservation initiatives (N. Jones et al., 2018). Involving the local community can also contribute to better decisions (Pendred et al., 2016) and reduced costs (Yates and Schoeman, 2014) of management actions. For those cases in which suggested management actions collide with the MPA goals—as, for example, allowing glass eel fishing—it is crucial that decision-

makers effectively communicate the reasons for choosing or dismissing such management actions.

Limitations

Although studying of perceptions is useful to help improve conservation initiatives, (e.g., (Bennett and Dearden, 2014; Chaigneau and Brown, 2016; Bennett et al., 2019), I acknowledge the limitations associated with the subjective nature of perceptions. According to (Bennett, 2016), the constructed nature of perceptions means that they may not objectively represent social and ecological outcome variables; may be intentionally inaccurate; or may be used to infer causality when counterfactual evidence is lacking. Assessments of stakeholders' perceptions also tend to report more negative outcomes than those that objectively determine outcomes (Ban et al., 2019). This could be related with the identity of those who measure the outcome—that is, stakeholders vs. scientists—, and because objective and subjective measures capture different aspects of human well-being: subjective measures are better suited for incommensurable well-being attributes such as identity, spirituality, or sense of place (Ban et al., 2019). Another limitation of this study is the relatively limited number of 29 interviewed stakeholders from one MPA. Yet, while these findings may not be generalisable, these study's interviews and focus group discussions provided rich and insightful data that helped elicit stakeholders' perceptions of Litoral Norte MPA.

Way forward

Future research should look at how values, attitudes, beliefs, and norms shape people's perceptions of conservation initiatives. And how different stakeholder groups perceive the effects of conservation interventions in ecosystem services and associated well-being benefits. Importantly, assessments of conservation initiatives should look at how power and institutional dynamics are perceived by different stakeholder groups, and

how they shape social-ecological trade-offs and outcomes. By doing so, researchers may be able to provide insights about the underlying factors that shape the success of conservation initiatives.

Here, I investigated how stakeholders perceive ecosystem services, human well-being attributes, pressures, and trends since the creation of Litoral Norte MPA in 2008. I also articulated stakeholder's perceptions by examining their suggestions to improve MPA governance and management. The network analysis applied in this study showed to be a suitable approach to reveal, articulate, and visualise patterns of perceptions collected through in-depth qualitative methods (Pokorny et al., 2017). Importantly, it allowed me to show that mismatches between perceptions of managers and local resource users can hinder local support for conservation initiatives aimed at improving biodiversity and human well-being.

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Chapter 4

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4.
Future visions of Litoral Norte MPA for biodiversity and people

Introduction

Marine protected areas (MPAs) are widely used strategies to safeguard biodiversity and related ecological processes and functions (Lester et al., 2009; Edgar et al., 2014). Although MPAs have been primarily designed to safeguard ecological values, they are increasingly promoted for their contribution to human well-being through the provision of ecosystem services (Potts et al., 2014). There are examples of MPAs that enhance local fisheries (Cinner et al., 2016), create opportunities for tourism (Sala et al., 2013), contribute to human health (Aswani and Furusawa, 2007), and preserve cultural heritage (NOAA, 2017). Yet MPAs can also be a source of social injustice when social dynamics are neglected (Mascia, 2004). This can result in negative impacts not only on local communities, but also on the ecosystems that MPAs are intended to protect (Bennett and Dearden, 2014).

Negative social impacts are often complex and varied. They may include equity issues when, for example, fishing community members feel marginalised in favour of other groups such as tourism operators (Blount et al., 2007). Negative social impacts

may also be felt when access restrictions contribute to the loss of local communities' place attachment, cultural heritage, and social identity (Outeiro et al., 2019). Possibly due to an increasing notion of the social impacts of MPAs and the need of social support for their success (Bennett et al., 2019), the social dynamics of MPAs have been receiving greater research attention (Ban et al., 2013; Bennett and Dearden, 2014; Ban et al., 2019). A growing recognition and understanding of MPA social dynamics may result in more transparent decisions about trade-offs inherent to conservation. Failing to explicitly recognise hard choices inherent to trade-offs between biodiversity conservation and human well-being might result in poor implementation of conservation efforts.

In multiple-use MPAs, human and environmental systems are interdependent and thus can be considered coupled social-ecological systems (Berkes et al., 2008). Yet, although approaches to conservation have been changing, the recognition that protected areas are usually embedded in complex and interconnected social-ecological systems is not widespread in conservation governance (Palomo et al., 2014). Not recognising protected areas as social-ecological systems has several limitations in a context of global environmental change and increasing cross-scale human impacts. One is that protected areas may not be able to adapt to changing social and ecological conditions over time, hence failing to achieve conservation goals and objectives (Cumming et al., 2015). Other is that they might be contributing to the disconnect between society and non-human nature by failing to recognise local communities' values, needs, and rights when protected areas are established, creating conditions for social conflict (Palomo et al., 2014).

A social-ecological systems perspective to marine conservation may provide several advantages. By explicitly addressing social dynamics, governance can be improved and social support for conservation tend to increase (Bennett et al., 2019). A "people and nature" framing (Mace, 2014) within a social-ecological systems perspective may also better equip conservation practitioners to deal with synergies, trade-offs and feedbacks between ecosystem services, as well as threats and drivers of change (Cumming,

2016). By incorporating the ecosystem services concept, a social-ecological perspective may also extend the inherent value of biodiversity to other types of value such as biodiversity's social, cultural, economic, and relational values (Chan et al., 2016). These values arise from benefits experienced by people at different scales, highlighting the need to safeguard important areas for biodiversity, even for people that live far away from protected areas. Experiencing ecosystem service benefits at different scales can also emphasize social tensions between people whose livelihoods depend on protected area resources and those who use it for recreation (Iniesta-Arandia et al., 2014). In this context, identifying, assessing, and protecting both vulnerable and important ecosystem services for local communities' livelihoods can create synergies between conservation and human well-being in multiple-use protected areas (García-Llorente et al., 2018).

Participatory processes can provide a nuanced understanding of social dynamics as they are able to create spaces of sharing, collaboration, and co-creation of knowledge and positive future transformations (Pereira et al., 2018). A useful way to think about desired futures of social-ecological systems is by creating and applying participatory backcasting exercises in workshops, involving both stakeholders and experts (Dreborg, 1996; Carlsson-Kanyama et al., 2008). Participatory backcasting is usually applied to long-term complex issues such as the reconciliation of biodiversity conservation and human activities in protected areas. In these exercises, participants are invited to envision desirable futures and explore pathways to achieve those futures. Backcasting is thus a normative method that allows for exploration and discovery, which may result in consensual management strategies for social-ecological systems (Palomo et al. 2011). Backcasting and similar participatory scenario exercises have been successfully applied in conservation contexts (Oteros-Rozas et al., 2015).

In this chapter I describe a workshop where participants have explored positive future visions for Litoral Norte MPA. And where workshop participants provided insights about the main ecosystem services of the MPA. To this end, I ask the following research questions:

- Which positive future visions do stakeholder groups have for Litoral Norte MPA in 2030?
- Which concrete actions can be carried out to attain those positive future visions?
- Which perceptions do stakeholder groups have about the spatial distribution, past trends, and contributions to human well-being of the main ecosystem services generated in Litoral Norte MPA?

Methods

Workshop themes and participants

We designed the workshop around four themes that are key for the future of Litoral Norte MPA:

- biodiversity conservation;
- small-scale commercial fisheries;
- tourism and nautical activities;
- governance and planning.

Each theme was assigned to a group of participants with professional experience on the respective theme. Workshop participants included a professional fisher (1); a representative of the local fishers' association (1); maritime tourism operators (3); representative of the municipality of Esposende (2); researchers of both the natural and social sciences (9); and representatives of the National Institute for Conservation (2)—the Portuguese institution that manages Litoral Norte MPA. There were a total of 18 people participating in the workshop. The one-and-a-half-day event took place in a public venue of the municipality of Esposende, on the days 17 and 18 January 2019 (Garcia Rodrigues et al., 2019).

Workshop structure

The workshop was structured in several phases. To contextualise the workshop and to provide background about the current situation of Litoral Norte MPA, we set time for brief plenary presentations, with question slots available between presentations to clarify doubts or misunderstood issues. We started by presenting the aim and objectives of the workshop. Then a representative of the National Institute for Conservation explained the institute's management strategy for the MPA. Following, a representative of the Marine Observatory of Esposende (OMARE, 2019)—a project conducting a marine biodiversity inventory in the MPA—reported key findings about local marine biodiversity. We ended this phase with a brief introduction to the ecosystem services concept. These presentations were prepared with a broad audience in mind. We adapted the scientific contents and avoided scientific jargon and overly technical details.

After providing context to participants, we did participatory mapping exercises. We grouped participants according to the four workshop themes. Yet, due to the low number of participants in the fisheries and tourism groups, we decided to join the two groups in the mapping exercises. In this phase we asked participants to map areas with the greatest capacity to provide five ecosystem services previously identified as among the most relevant for local people (chapter 3). These ecosystem services were:

- maintaining species and habitats;
- coastal protection and erosion regulation;
- harvestable fish;
- contribution to cultural heritage and local identity;
- opportunities for tourism and nautical recreation.

Besides identifying areas with capacity to provide these ecosystem services, participants evaluated how the capacity of the MPA to provide ecosystem services have changed in the last 10 years. This exercise ended with the assessment of the ecosystem services importance to human wellbeing, and with the identification of the main beneficiaries of the services. Both the capacity of the areas to provide ecosystem services

and the 10-year trends were classified with an associated uncertainty, ranging from low, medium, to high.

The last phase of the workshop was set aside for the development of positive future visions of Litoral Norte MPA in 2030, and for brainstorming concrete actions to attain those visions. Since creating future visions was one of the main goals of the workshop, we allocated a substantial amount of time to this phase—a part of the first day afternoon and the full second day morning. We decided to keep this phase at the end of the workshop, so participants were more familiar with each other, had already had plenary discussions about MPA issues, and had mapped, in groups, ecosystem services provided by the area. As such, they were more aware and familiar with the main issues at hand, and hence were better prepared to create future visions.

To develop positive future visions for the MPA, we rearranged the participants into two main groups. The goal was to have a diversity of opinions, thoughts and interests in the development of positive future visions, and hence this time groups were not thematic but included participants from all previous group themes. Groups were invited to draw, tell a story, or write a narrative about their preferred futures. After creating their future visions, a representative of each group presented the vision to all workshop participants.

We were also interested in imagining pathways to achieve the envisioned positive futures. To do so, participants were invited to propose concrete actions to attain the futures. Participants also identified who should be responsible to take action; how such actions could be funded; and when should actions start. At the end, all actions were presented in plenary. After the communication of the proposed actions, we gave four votes to each workshop participant who could assign one vote to a preferred action. The workshop ended with a plenary discussion about the most voted actions and on what could be done in the short-term future to put the actions into practice.

Workshop facilitation

The workshop was steered by an experienced facilitator who gave room to, and encouraged, all participants to share their thoughts, views, and hopes about biodiversity, ecosystem services and human activities of the MPA. Participants had plenty of opportunities to interact in plenary discussions, and to immerse themselves in targeted group deliberations. To capture the diversity of perspectives, we audio-recorded all plenary and group discussions, with participants' consent. We used the audio recordings to support our analysis of the workshop outcomes.

Results

Positive future visions for Litoral Norte MPA

Workshop participants created two different narratives for a positive future of Litoral Norte MPA in 2030. Groups named their narratives "Dream Big", and "Sharing: knowing, observing, divulging, protecting".

The narrative "Dream Big" (**Box 1**) was set up around the integration of different types of knowledge, such as scientific and local traditional knowledge, to support MPA planning and management. Group members discussed the potential of integrating diverse knowledge sources into management to increase the legitimacy and robustness of actions taken by MPA managers. For example, by considering local traditional knowledge, MPA managers would implicitly recognise the experience and contribute of the local community—that is, fishers, gleaners, fish vendors, tourism operators, and so on. According to this narrative, the integration of local traditional knowledge could improve the legitimacy of MPA managers' decisions in the local community.

Box 1. Narrative of the future vision "Dream Big".

«This vision is entitled "Dream Big" because it's quite ambitious. In our vision we see nature conservation improved. For that we need MPA management based on different types of knowledge such as scientific knowledge and local traditional knowledge, so decision-making can be sound and legitimate. In that sense, we must find processes that allow for fair and thorough integration of such types of knowledge. We also envision an increased knowledge baseline about the MPA by building on the effort that Project OMARE is undertaking [this project is currently doing an inventory of marine species presence and abundance, as well as communicating its results to a general audience]. The new knowledge generated should be the basis of integrated and adaptive management plans that consider environmental and climate change, which is occurring now and will go on in the future.
In the short-term, we see Litoral Norte MPA embedded in a national and European network of MPAs because species move and therefore there must be connectivity between protected areas. Besides the ecological network, we also envisage a network of people and institutions that share information and data to better manage the MPA network.
We envisage MPA authorities valuing more the cultural heritage of the area, as well as local and traditional activities such as small-scale fishing. There are also unexplored opportunities in the MPA. Harvesting seaweed and Salicornia [an edible plant that grows in local saltmarshes] creates new economic opportunities for local people. Such harvesting is carried out in a responsible and sustainable way. We also see better promotion of nature tourism by MPA managers. In the long-term this is positive for the protection of the ecological values of the area and for local people who now depend on seasonal beach tourism. Therefore, seasonal mass beach tourism gradually changes to tourism activities closely related to the enjoyment of nature throughout the whole year, thus decreasing high seasonal pressures to the MPA caused by beach tourism.
We also envisage more and better communication between MPA managers and users. Communication about habitats, species, ecosystem services and values held by the MPA; the reasons that justify the existence of the MPA; and why specific delimitations and restrictions in the MPA are in place. In this way, the legitimacy of the MPA for the local population could be strengthened in the future.»

The group that created the narrative "Dream Big" envisioned a future where MPA managers would increase their scientific knowledge base about marine ecosystems, habits and species to support more robust and sound decision-making. With a stronger scientific input, MPA managers would be better equipped to consider the already felt negative effects of climate change (e.g., sea level rise; more frequent and intense storm surges). Moreover, the narrative stressed the importance of adopting adaptive management to have a decision-making process flexible enough to change according to the needs of protecting essential ecological functions and ecosystem services under uncertainty.

Another vision of the narrative "Dream Big" was reconciling different values of Litoral Norte MPA. Ecological, geological, social, cultural, and economic values would all be relevant for management decisions. According to the group, both scientific and local traditional knowledge could play a fundamental role in eliciting the diversity of values of the MPA, and help prioritising future management actions. Moreover, the group's positive future envisioned a wide dissemination among the public of the MPA plural values. There would be an MPA research and dissemination centre with the aim of informing the public about the rationale behind the creation of the protected area, the reasons why certain restrictions and area limits are in place, and the contributions of nature to people's well-being. With these actions, the group envisioned an increasing environmental awareness and education among the public.

The narrative "Sharing: knowing, observing, divulging, protecting" (**Box 2**) focused on sharing the responsibility of MPA management, research, and outreach between MPA managers and users. To that end, the group considered the ecosystem services concept useful to highlight the direct and the more hidden contributions of the MPA to users' and visitors' well-being. According to the group, a management approach based on the ecosystem services provided by the MPA could be a useful strategy to manage the carrying capacity of the system to accommodate not only current human activities undergoing in the area, but also to anticipate new activities that might occur in the future. In this sense, such strategy could help promoting a more integrated management approach that includes both biodiversity and human activities that depend on the ecosystem services of the MPA. Yet, the group considered that such an integrated management approach would need to be linked to effective enforcement, systematic monitoring, and active communication of rules, restrictions and limits of the MPA by local authorities.

Box 2. Narrative of the future vision "Sharing: knowing, observing, divulging, protecting".

«Information, knowledge, responsibilities, and management need to be shared. To that end, our future vision includes the creation of a research centre in fort of S. João Batista [fort located inside the protected area].

Our vision promotes integrated, dynamic and participatory management based on knowledge about ecosystem goods and services. An MPA management plan based on our vision integrates all human activities that exist nowadays in the protected area and anticipates those activities that might occur in the future. In the short-term, we see a safe and easy access to the Ofir beach for surfers. We also envision a future assessment of the glass eel (Anguilla anguilla) abundance in the Cávado estuary to know if it is reasonable to create catch licences for local fishers, so they can have a source of income during the winter months. Our future vision also entails an MPA with higher public visibility and visitation rates.
This future vision involves a more effective enforcement and monitoring plan, and better communication between who manages and who uses the MPA. In our vision, we have reduced pollution from water and land. And the beaches of the MPA have sand hoppers and seaweed because of the ecological function they represent, namely as food source for shore birds, recycling of nutrients, and so on.
In our vision we have more information about MPA limits, which are presently ill-signposted. Also, we envisage the Litoral Norte Site of Community Importance coinciding with the limits of the MPA in the future, which is not currently the case.»

The narrative "Sharing: knowing, observing, divulging, protecting" also entailed specific visions of local issues. One of these issues was related with a need for improved access to a local beach known for surfing. Other issue had to do with the current prohibition to catch glass eel in the MPA estuary. Glass eels are juveniles of the critically endangered European eel (*Anguilla anguilla*). Local fishers claim the right to fish glass eel in the winter months which coincides with the period of the year when fishers cannot go to the sea due to rough weather and sea conditions. Yet, biologists, ecologists and local environmental activists warn that a lift on the prohibition to catch glass eel would put a greater pressure on the already dwindling population of European eels. To have an accurate picture about the present situation of glass eels in the MPA estuary, this narrative proposed assessing the glass eel population to know if and in what conditions the demands of local fishers could be accommodated. Another issue that came up during the workshop was related with beach sanitising done by the municipality, which allegedly removes insects and seaweed from MPA beaches. This led this group to call for a future in which MPA beaches would have sand hoppers (*Talitrus saltator*) and seaweeds which were considered important by the group for the ecological balance of beach ecosystems, as they are nutrient sources for other species.

However, this issue was later clarified by a representative of the municipality who reported that only two local beaches are occasionally sanitised due to allowed access of pets.

Actions proposed to achieve positive future visions

After developing a narrative about positive future visions for Litoral Norte MPA, groups proposed concrete actions to achieve their visions and identified who should be responsible to implement each action (**Table 6**). Participants then voted each action individually.

Table 6. Actions proposed by groups to achieve the envisioned positive future visions. Vision 1: "Dream Big". Vision 2: "Sharing: knowing, observing, divulging, protecting".

Action	Description / rationale	Who should do it?	Vision	Nr. votes
Set up a local biodiversity research and dissemination centre	This centre would co-create knowledge and contents about the MPA. It would cover the need to improve scientific knowledge and raise awareness about the biodiversity held by the MPA	Municipality, National Institute for Conservation, universities	1, 2	13
Certification / MPA label of sustainable products	As there are economic activities inside and in the vicinity of the MPA, certifying sustainable fishing or agriculture products could add value to local produce and incentivise producers towards sustainability.	Local trade associations, fishers, local restaurants	1, 2	9
Obtain a "Social Licence" from the local population	Obtaining a "Social Licence" would be a process in which MPA managers would need to justify and negotiate their main decisions with the local population to obtain approval or acceptance to act.	MPA Executive Committee, National Institute for Conservation, municipality	1	9
Establish an effective long-term biodiversity monitoring program	A comprehensive biodiversity monitoring program is currently lacking. Such program is crucial to apply effective biodiversity conservation strategies.	National Institute for Conservation	1	8
Improve communication with the public	The public have generally poor knowledge about local biodiversity, do not know why certain areas are restricted, or where are MPA limits. A well-though communication program would help raise awareness toward the need to protect local biodiversity and comply with park restrictions.	National Institute for Conservation (content development), municipality (dissemination), tourism operators (dissemination)	1, 2	5
Establish a network of national MPAs	A network to improve the connectivity between MPAs to protect larger portions of species life cycles. And a network of institutions that can share experience and information for better management.	National Institute for Conservation, Ministry of the Sea	1	3

End water pollution	There are regular industrial waste discharge and fertiliser run-off from agriculture in the Cávado river. Waste regulations need to be better enforced to end river, estuary and the marine pollution.	Municipality, Portuguese Environment Agency, Regional Hydrographic Administration	2	3
Set up a Citizen Science Program for the MPA	Promoting a Citizen Science Program would bring benefits to biodiversity conservation strategies as it would improve the knowledge and possibly the interest of the local population.	Citizens, park users, park visitors, fishers, farmers, NGOs, universities	1	3
Improve access to Ofir beach for surfing	Ofir beach is one of the main local surfing areas. A better access would improve safety and overall conditions for surfers and beach goers.	Municipality	2	2
Redefine / increase MPA limits	There are vulnerable species and habitats whose conservation would benefit if the whole MPA was under Natura 2000 network, and the marine area under the Site of Community Importance, which already exists on land. No-take zones could also improve the condition of vulnerable habitats and species.	National Institute for Conservation	1, 2	2
Apply an integrated approach to MPA management	Different management plans from different local institutions should be integrated in a single plan. Also, integrated management implies co-creating solutions with local people, solutions that consider different types of values (ecological, sociocultural, economic).	MPA Executive Committee	2	2
Control invasive coastal plant species	Cutting and removing invasive plant species, and planting autochthonous species, would improve local ecological health. This would need a maintenance program to be effective over the long-term.	National Institute for Conservation, property owners	1	1

The most voted action was the creation of a biodiversity research and dissemination centre, with 13 votes. Both groups proposed a similar action. According to groups, a biodiversity research and dissemination centre would create new knowledge and would help raise awareness among the public about the importance of local biodiversity and ecosystem services. Groups highlighted the linkages between the creation of this centre with other actions. Functioning as a knowledge and communication hub, the centre could also be responsible for implementing a long-term biodiversity monitoring program, and for improving the communication with the public about MPA values, limits and restrictions. Centre researchers could also check and validate information gathered by the MPA Citizen Science Program—another action proposed by one of the groups. Groups acknowledged the pivotal role that a biodiversity research

and dissemination centre would have in covering a broad set of aspects of their future visions.

Among the most voted actions was the creation of a label for sustainable MPA fishing and agricultural products. This action would promote and add value to local traditional activities, which was one of the visions of the narrative "Dream Big". According to this narrative, people could pay a premium price to access sustainable MPA products which would incentivise local producers to apply for having their products labelled by producing sustainably. Group members considered that this action could help to decrease negative impacts and pressures from fishing and agriculture on local biodiversity and ecosystem services.

Another popular action proposed in the workshop was the creation of a Social License for MPA management. This action aligns with the future vision of the narrative "Dream Big" in which the legitimacy of the main decisions taken by MPA managers is improved. A Social License would be obtained when a conservation action had the approval of the local community. According to group members, negotiating and obtaining a Social License from local MPA users could help decreasing conflicts arising from unpopular decisions such as the implementation of restrictions or area closures. Since local users would participate in decision-making, decisions would also be their own, and thus responsibility toward compliance would tend to improve. During workshop discussions both groups acknowledged that a Social License could be also a useful process to redefine and increase MPA limits in the future, which was an action proposed by both groups. Local users could be called to give their input to approve future overlapping of MPA limits with the limits of Litoral Norte Site of Community Importance, which currently do not overlap. This would align with the vision of the narrative "Sharing: knowing, observing, divulging, protecting".

With fewer votes, the action to establish an MPA network in Portugal by the narrative "Dream Big" was proposed to improve nature conservation. Since many marine species have mobile phases during their lifecycles, having protected corridors between protected areas could improve species' protection. Besides this ecological network, the

group also proposed a network of institutions with a stake in national MPAs. Such network could help managers and practitioners of different MPAs to share experience and data that could result in improved MPA performance. During plenary discussions, groups mentioned that this action could link to the action about integrated management proposed by the narrative "Sharing: knowing, observing, divulging, protecting". This action would combine different environmental management plans from local institutions into a single plan that would inform requests by the institutional network of national MPAs.

Perceived capacity of Litoral Norte MPA to provide ecosystem services

After brief group discussions about ecosystem services, group members mapped the areas of Litoral Norte MPA with the greatest capacity to provide five important ecosystem services for the local community (**Figure 14**). These ecosystem services were maintaining species and habitats; coastal protection and erosion regulation; harvestable fish; contribution to cultural heritage and local identity; and opportunities for tourism and nautical recreation. Besides mapping, groups identified past 10-year trends of the area's capacity to provide each of the five ecosystem services (**Table 7**). Moreover, they assessed the contribution of each ecosystem service to human well-being (low, medium, and high). And identified the main beneficiary groups of each ecosystem service (**Table 7**). All assessments were complemented with qualitative evaluations of associated certainty levels (low, medium, and high).

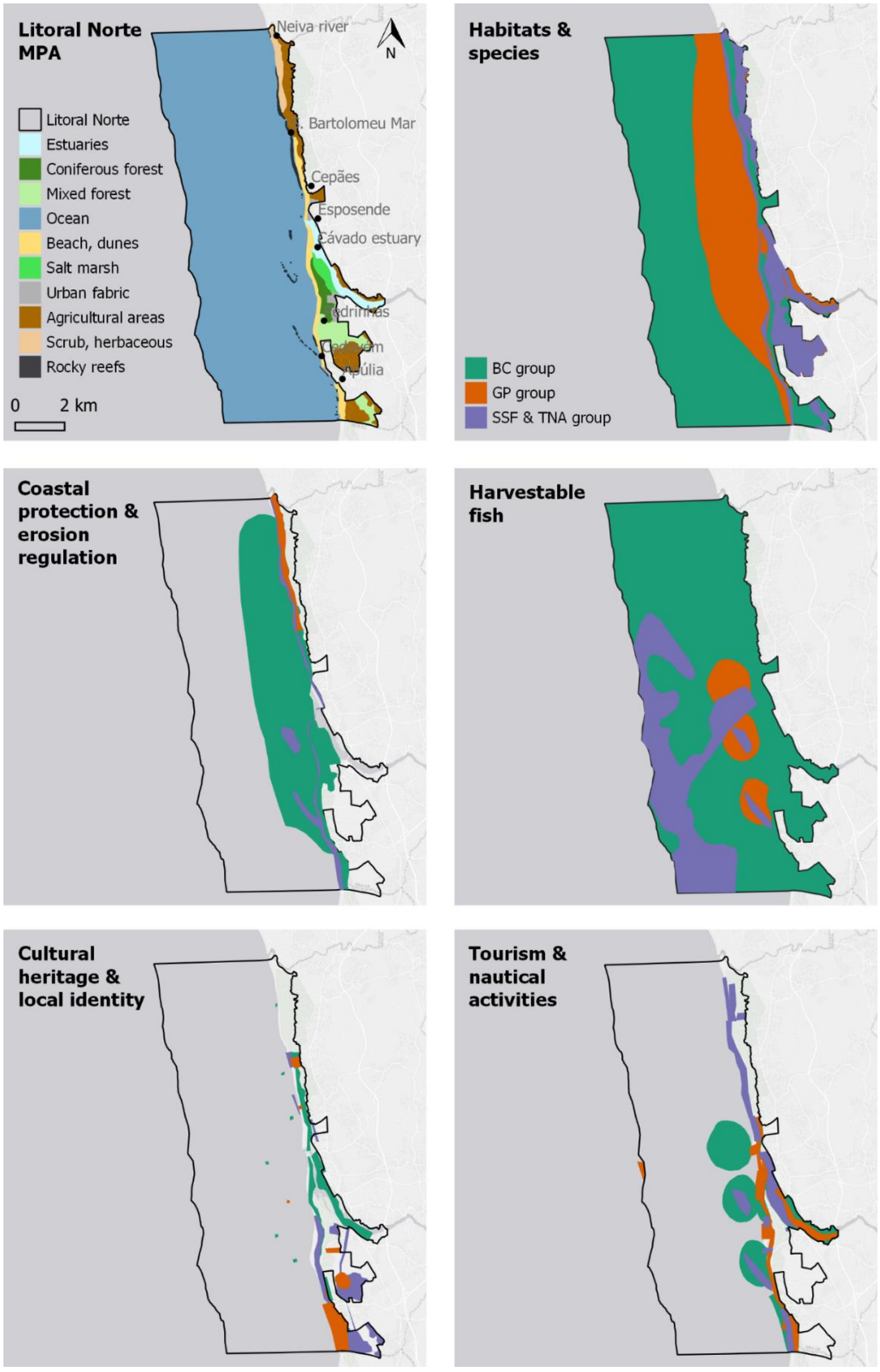

Figure 14. Perceived capacity of Litoral Norte MPA to provide ecosystem services, according to workshop participants. Top left map indicates marine/land cover; all other maps correspond to one ecosystem service mapped by workshop groups. Colours of ecosystem service maps represent one workshop group: biodiversity and conservation (BC), governance and planning (GP), and small-scale fisheries & tourism and nautical activities (SSF & TNA).

Groups of small-scale fishers and tourism and nautical activities (SSF & TNA), and biodiversity conservation (BC), considered that the whole area of Litoral Norte MPA has a substantial capacity to maintain species and habitats (**Figure 14**). The BC group could not highlight specific areas, considering that the whole MPA is very important for species and habitats. The BC group could also not assess the area's past ecosystem services capacity trends due to lack of scientific assessments done in the area. With a high certainty, the SSF & TNA group mapped coastal areas important for kelp, considering that kelp areas have been decreasing over the past 10 years in the MPA (**Table 7**). This group also mapped salt marshes and reed beds of the Cávado estuary and Neiva river, identifying these areas as important habitats for birds, amphibians, reptiles, mammals, and fish.

The governance and planning (GP) group also mapped areas with capacity to maintain species and habitats, although the group avoided mapping a considerable extent of the marine area due to high uncertainty. Yet a varied number of areas were highlighted by the group. With high certainty, the group identified the Cávado estuary as an area with high capacity to maintain species and habitats. According to the group the estuary is subject to high human pressure and tends to degrade in some areas, especially at the estuary mouth. Invasive plant species have been controlled in the estuary margins and its ecological status has improved. The water column of the estuary was considered stable by the group. In the marine area, the group highlighted the importance of the rocky reefs of Apúlia, Pedrinhas, and Ofir. However, current and past trends of the reefs' condition are unknown due to lack of scientific assessments and monitoring.

All groups considered that the capacity of Litoral Norte MPA to maintain species and habitats was of high importance to human well-being (**Table 7**). As main beneficiaries of this ecosystem service, groups have identified the general public, and specifically, the local population: local fishing communities, local people engaging in economic activities, and those who do recreational activities in the area.

Table 7. Perceived past 10-year trends of ecosystem services provided by Litoral Norte MPA. Table also shows workshop participants' perceptions of ecosystem services' contribution to human wellbeing, and main ecosystem service beneficiaries. Group results were combined into a single table for an overview of stakeholders' perceptions about ecosystem services.

Ecosystem service	Service providing unit	Past 10-year trends	Contribution to human wellbeing	Main ecosystem service beneficiaries
Maintaining species & habitats	Rocky reefs	→	High	Local population, fishing communities, local businesses, tourism operators, tourists
	Kelp forests	↓		
	Cávado estuary	→		
	Cávado estuary shoal	↓		
	Saltmarsh (left margin Cávado estuary)	↑		
	Saltmarsh (righ margin Cávado estuary)	↓		
	Humid dune slacks, north	↑		
	Humid dune slacks, south	→		
	Coastal broadleaf patches	→		
	Reed beds	↑		
	Marine species	→		
Coastal protection and erosion regulation	Dune system	→	High	Local population, local fishing communities, local businesses, tourism operators, tourists
	Pebble beaches	→		
	Sand beaches	↓		
Harvestable fish	Commercial fish species	→	Medium to high	Local fishing communities, fish auction market sellers, fish consumers
Contribution to cultural heritage & local identity	S. Bartolomeu do Mar festivities	↑	High	Local population, local fishing communities, local businesses, tourism operators, tourists, heritage
	"Barco" buildings of Pedrinhas	↑		
	Masseiras	↓		
	Apúlia mills	→		
	Apúlia fishing community	→		
	Sargaceiros' costumes	→		
	Sargaceiros' activity	→		
	Cavalos de Fão legend	→		
	Roman salt pans	→		
Opportunities for tourism and nautical recreation	Sand beaches	↓	Medium to high	Tourists, tourism operators, local businesses, local population
	Cávado estuary	→		
	Marine area	→		

Trend

↑ Increased
→ Stable
↓ Decreased

Certainty

High
Medium
Low

COASTAL PROTECTION AND EROSION REGULATION

All groups identified and mapped rocky reefs and marine rock outcrops of the coastal zone as elements that provide coastal protection and erosion regulation (**Figure 14**). For example, the BC group highlighted the important role of rocky reefs and rock outcrops in dissipating wave and tidal energy, reflecting a continuum of coastal protection along the entire MPA coastal zone. The certainty of the mapping and assessment was considered high by the BC group. This group highlighted that coastal erosion is not only caused by the sea, but also by the wind, an effect that is attenuated by local dunes and saltmarsh vegetation. The group also identified kelp forests as sediment stabilizers and wave energy dissipators, and as such, stressed their important role for coastal protection, with high certainty. BC group members were also highly certain of local pebble beaches' function in dissipating sea energy.

Likewise, the SSF & TNA group identified and mapped the role of dunes and rock outcrops as natural elements that control coastal erosion. Yet, the group did not reach consensus about the importance of kelp in dissipating wave energy. As the BC group, the GP group stressed the importance of rock outcrops, pebble beaches, and dunes for coastal protection and erosion control at different levels. At sea, rock outcrops and reefs function as natural breakwater elements that dissipate wave energy. Pebble beaches have a similar function in the intertidal zone, followed by dunes that function as the remainder physical barrier on land. The certainty of GP group's mapping and assessment was considered high.

Groups differed in their assessment about the capacity trends of the MPA for coastal protection and erosion regulation (**Table 7**). With high certainty, the SSF & TNA group considered that the amount of sand of local beaches have been decreasing, indicating that erosion is high in the area. Due to similar reasons, but with low certainty in their assessment, the BC group assumed that erosion is increasing in the MPA. Contrary, with high certainty, the GP group considered that local dunes and pebble beaches have remained stable over the past 10 years due to low human pressure,

indicating that the capacity of the area to protect the coast and regulate erosion has remained about the same.

Groups considered that coastal protection and erosion regulation had a medium to high contribution to human well-being, especially for the local coastal population (**Table 7**).

HARVESTABLE FISH

Both the SSF & TNA, and the BC group, identified the whole area of Litoral North with capacity to provide commercial fish species (**Figure 14**). Yet, the GP group highlighted three main areas for fisheries: rocky reefs and rock outcrops, sea area off the estuary mouth, and sea area off Apúlia beaches.

The SSF & TNA group stressed that virtually all local small-scale fishing occurs within Litoral Norte MPA, about two nautical miles off the coast. As such, the entire marine area is important for local fishers. The most caught and important commercial species are sea bass, sea bream, horse mackerel, pout, brill, skate, and octopus. When conditions at sea are not suitable for fishing, which corresponds mainly to winter months, the Cávado estuary becomes the main fishing area. Marine rock outcrops are also sought after for goose barnacles harvesting.

When assessing the past 10-year trends for harvestable fish, groups highlighted the high uncertainty associated with fishing due to lack of data, assessments, and monitoring (**Table 7**). With medium certainty, the SSF & TNA group considered that the abundance of some commercial species has been declining, while for others species it has been increasing. Yet, both SSF & TNA and GP group members assured that catch volume has remained constant, as well as the number of fishers and gear type. GP group members considered that the amount of fishing gear used has been increasing, possibly indicating higher fishing effort.

The contribution of harvestable fish for human well-being was considered high by the SSF & TNA group, while the BC and the GP groups considered it a medium

contribution to human well-being (**Table 7**). Groups identified fishers, food service, and fish consumers as the main beneficiaries of this ecosystem service.

CONTRIBUTION TO CULTURAL HERITAGE AND LOCAL IDENTITY

All groups agreed that Litoral Norte MPA holds a diverse cultural heritage and identity associated with the marine environment (**Figure 14**). In fact, the cultural features identified and mapped by the groups had much in common. For example, all groups highlighted the importance of *sargaceiro* (traditional seaweed harvesters) costumes and their activity; local fishing communities; Apúlia mills and *masseiras* (traditional farming fields dug into sand dunes); S. Bartolomeu do Mar pilgrimage; Fort of S. João Batista; or centennial shipwrecks that exist along the MPA coastal zone.

SSF & TNA group members warned that *masseiras* have been losing their original features due to sand removal from their slopes (**Table 7**). The purpose of sand removal was linked to farming area expansion, and to sand extraction for sale. Yet, GP group members considered that cultural heritage and local identity elements have been stable during the past years. This group denoted that immaterial cultural elements such as traditions and festivities have been kept alive by local communities, strengthening local cultural practices and identities. Moreover, the group considered that material cultural elements such as forts, mills, or archaeological sites are overall well preserved. The group assessed these cultural ecosystem service trends with a high degree of certainty.

Except for the BC group, the SSF & TNA and GP groups considered that cultural heritage and local identity provides a high contribution to human well-being (**Table 7**). The main beneficiaries identified by these two groups included local population, tourists, fishing communities, people involved in economic activities, and people exploring recreational opportunities. BC group members considered that cultural heritage and local identity provides a medium contribution to human well-being, mainly to people involved in maritime tourism and related activities.

OPPORTUNITIES FOR TOURISM AND NAUTICAL RECREATION

There was a consensus among groups about the capacity of Litoral Norte MPA to provide opportunities for tourism and nautical recreation (**Figure 14**). In fact, groups identified three main zones for tourism and recreation in the MPA: coastal fringe, Cávado estuary, and sea. In the coastal fringe, groups highlighted the importance of beach tourism, surfing, and hiking. The Cávado estuary was identified due to its natural conditions for kitesurfing, canoeing, bird watching, and angler fishing. For the sea, groups highlighted recreational fishing, diving, and have also mentioned the potential of the MPA for cetacean watching. Groups were highly certain about their assessments.

Regarding past 10-year trends, the SSF & TNA group denoted that tourism – mainly beach tourism, but increasingly nature tourism – has been growing in the area, as indicated by the current 256 registered short-term rentals for tourism and several hotels (**Table 7**). Although beach tourism has been growing locally, the GP group warned that the capacity of the MPA to support this type of tourism might be decreasing due to growing erosion, resulting in less available sand in local beaches. Yet, all groups highlighted that opportunities for recreational nautical activities, such as kitesurf, windsurf, surf, or diving, is high in the area, and that demand seems to be growing.

Both SSF & TNA and GP groups considered that tourism and nautical recreation has a high contribution to human well-being, mainly to the local population, maritime-tourism operators, and tourism-related services (**Table 7**). The BC group identified similar beneficiaries of this ecosystem services, while considering that the overall contribution to human well-being was medium.

Discussion

The workshop aimed to broaden the range of possibilities for Litoral Norte MPA by stimulating participants to envisage positive futures and to propose concrete actions to attain those futures. As a result, workshop participants created two different—but complimentary—narratives for the MPA in 2030. Narratives mainly touched governance aspects such as the integration of different knowledge types and plural values in conservation decisions. Participants argued that co-creating conservation actions among scientists, conservation managers, and local stakeholders— and considering ecological, economic, social, and cultural values—could help to attain novel and creative solutions for the MPA. These solutions could help increase trust among stakeholders and improve the legitimacy of conservation decisions because they would incorporate inputs from a diverse group of stakeholders, hence achieving a shared responsibility of the decisions made (Young et al., 2013; Bennett and Dearden, 2014). Co-creating solutions with diverse stakeholders could also better account for the trade-offs and synergies between biodiversity conservation and human well-being by explicitly considering possibly different worldviews and conflicting interests (Ban et al., 2013; Arkema et al., 2015).

A social-ecological approach to MPA governance and management

Workshop participants proposed a varied set of actions to attain their envisaged positive futures of Litoral Norte MPA in 2030. Among the most voted actions were creating a local biodiversity research and dissemination centre; certifying sustainable MPA agricultural and fishing products; obtaining a Social Licence from the local population for the main conservation decisions; and establishing an effective long-term biodiversity monitoring program. What these and other proposed actions have in common is the incorporation in their rationale of both ecological and social considerations. These

actions explicitly consider the multiple-use reality of Litoral Norte MPA and its embeddedness in interconnected social and ecological systems (Berkes et al., 2008). In fact, considering not only the ecological system but also explicitly accounting for social goals, objectives, and ecosystem services—although challenging (Bennett et al., 2017)—, may result in more effective conservation outcomes (Ban et al., 2013). This is because a social-ecological approach to conservation can help increase social support for conservation initiatives by considering people's values, needs and rights (Bennett et al., 2019), and reduce social conflict by incorporating diverse stakeholder views (Berkes, 2004). A social-ecological approach is not a panacea for conservation (e.g., it may be ill-suited for strict marine reserves), but it offers promising opportunities for an effective, just, and balanced governance and management of multiple-use MPAs. While the management plan of Litoral Norte MPA does entail a few social considerations, the plan's limited scope may not align with the social importance of the MPA ("study area", chapter 1). However, the narratives and actions proposed in our workshop can stimulate conservation practitioners to think about the advantages and challenges of a social-ecological approach to conservation in future planning iterations of Litoral Norte MPA.

The role of ecosystem service assessments in MPA management

Narratives about positive futures and other exercises of our workshop explicitly considered, applied, and reflected upon the usefulness of the ecosystem service concept for MPA governance and management. One narrative envisaged an MPA future governance approach based on the ecosystem services provided by the MPA. Participants argued that it could be a useful approach to manage the carrying capacity of Litoral Norte MPA to accommodate not only present, but also future unanticipated human activities. This approach would require a sophisticated assessment of how ecosystem services are co-produced by social and ecological systems (Palomo et al., 2016). It would require understanding how ecosystem services interact with one another, how

changes in the local supply of ecosystem services influence the different dimensions of local people's well-being, and how changes in human well-being feedback and influence the generation of ecosystem services (Reyers et al., 2013). An ecosystem service approach to management would need to be complemented with more practical aspects such as effective enforcement, systematic monitoring, and active communication of rules, restrictions and MPA limits.

The ecosystem service assessment of our workshop can be viewed as a scoping exercise towards more in-depth future assessments in the area. In fact, it can help prioritise where and what future assessments of ecosystem services should look at. Although there were a few differences between assessments, the overall results were fairly consistent across groups. For example, all groups highlighted the medium to high importance of the five ecosystem services to local people's well-being, especially to those whose livelihoods depend on the marine and coastal environment. Future ecosystem service assessments in Litoral Norte MPA could complement these findings by prioritising those ecosystem services that are both the most important to local people's well-being and the most vulnerable to negative impacts (Iniesta-Arandia et al., 2014).

Assessing ecosystem service trends through stakeholder perceptions can also provide useful insights when information is lacking (García-Llorente et al., 2018). In fact, the assessment of ecosystem service trends of our workshop shed light on existing limitations. One was that there is a high uncertainty about the state of habitats and species in the marine environment of Litoral Norte, partly because biological data is scarce and because professional and recreational fisheries are hardly monitored. Yet the new Marine Observatory of Esposende has the potential to fill some of these knowledge gaps soon (OMARE, 2019). Another common assessment across groups was the perception that coastal protection and erosion regulation might be decreasing, while tourism and nautical activities are increasing. It is however unclear if and how these two trends are linked. Nevertheless, given the importance that both ecosystem services have for the region, understanding these trends should be a priority. Especially when considering the importance of coastal protection and erosion regulation to

safeguard local coastal ecosystems, agricultural fields, houses, and businesses; and the importance of tourism and nautical activities for the local economy and recreation.

Our participatory mapping of ecosystem services also provided interesting insights. While the BC group tended to analyse the MPA in a more integrated way—hence having difficulties in identifying very specific areas with capacity to provide ecosystem services—the other groups mapped with low uncertainty several important areas of ecosystem service provision. This exercise has resulted in rich maps of cultural heritage and local identity, tourism and nautical activities, and important sites for local fisheries. Besides important ecological values, these areas hold relevant social and cultural values which can be further researched to assess their "cultural significance" (Gee et al., 2017) in future planning efforts of Litoral Norte MPA.

What have we learned from the workshop?

Ideally, the workshop would have had a greater diversity of participants to hear and discuss a wider range of opinions and perceptions. We would like to have had more representatives of professional and recreational fishing, gleaning, maritime tourism activities, and non-governmental organizations. This was not possible due to unavailability of guests. Yet we believe that the workshop fulfilled our goals. Besides providing us with rich qualitative data about stakeholders' opinions and perceptions of the MPA, this participatory method enabled social learning, capacity building, and communication among stakeholders that often are not together discussing some of the issues they most care about. While engaging in workshop exercises, some participants have used their scientific knowledge, others their local traditional knowledge, while others have used both knowledge types to assess ecosystem services and propose concrete actions to attain positive futures. After all, workshop participants applied what they envisioned for Litoral Norte MPA governance: a future where different knowledge types, plural values, and diverse stakeholder perspectives are all considered to attain a positive future for biodiversity and people.

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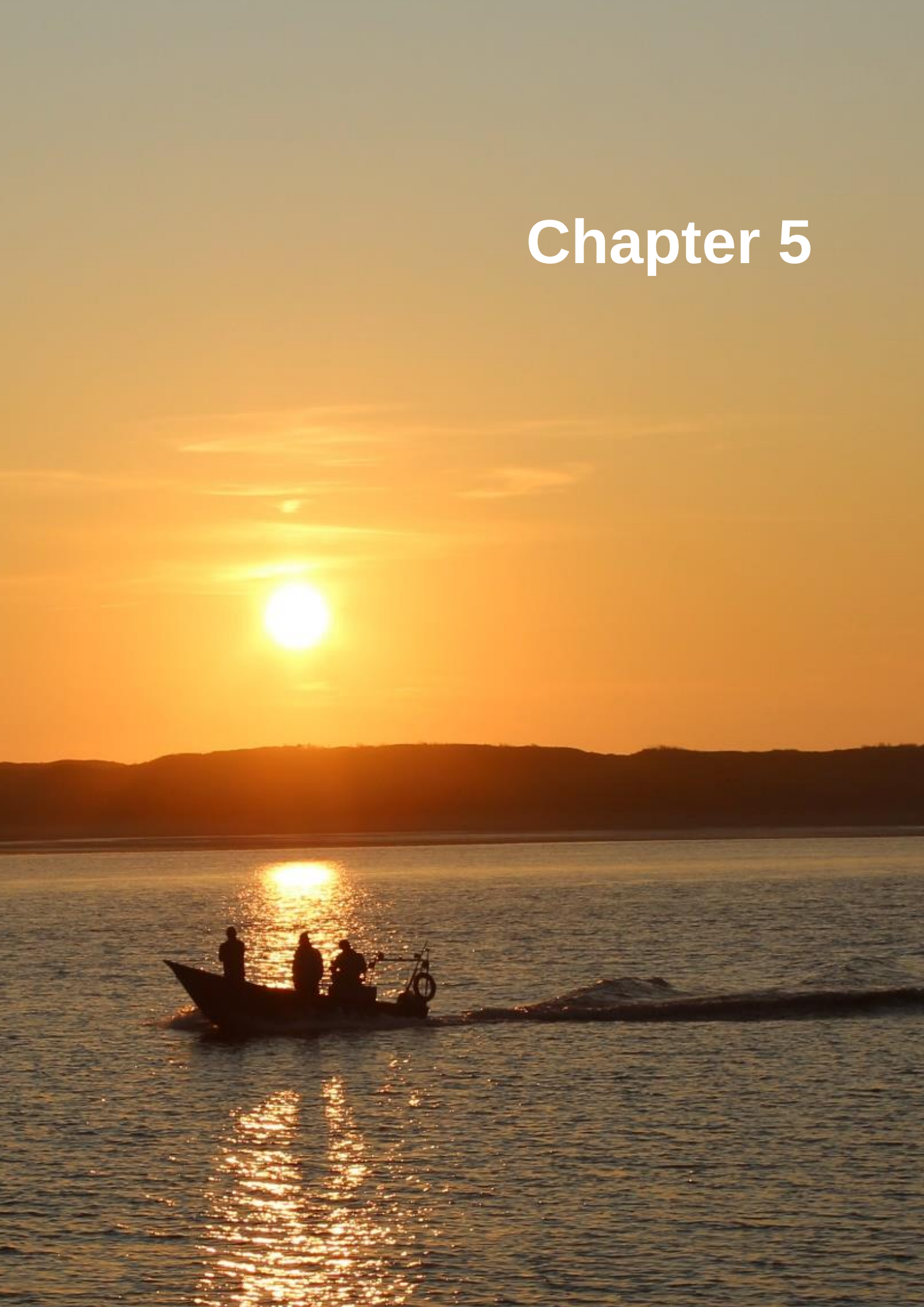

Chapter 5

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5.
Conclusions

This thesis focused on marine protected areas (MPAs) and their effects on multiple dimensions of human well-being. To this end, I have used the ecosystem service concept as a metaphor of human well-being dependence on non-human nature. Understanding the effects of marine conservation outcomes on human well-being is and will be central to conservation practice and policy as the number and extent of MPAs grow, and as humans change marine ecosystems. MPAs are promoted as effective strategies to safeguard both marine biodiversity and coastal livelihoods. Yet, while MPA design features that effectively safeguard marine biodiversity are well-known, comprehensive knowledge about the social dimensions of MPAs is still lacking. Specifically, it is not well understood how MPA outcomes positively and negatively affect different social groups reliant on ecosystem services provided in MPAs. Marine conservation practitioners and policymakers require more nuanced and detailed scientific information about how MPAs can effectively protect coastal livelihoods and foster human well-being. And for that, they a need a broader understanding of how different domains of well-being are affected by conservation actions. This is because those conservation practitioners that do assess the social dimensions of MPAs tend to neglect certain well-being domains. While economic and governance domains of well-being outcomes of MPAs are increasingly studied, social, health, and cultural domains are less known.

The overarching contribution of this thesis was to improve understanding on how MPA outcomes affect multiple dimensions of human well-being. To do so, I have studied Litoral Norte MPA in northern Portugal, and collected data on perceptions, aspirations, and understandings of diverse social groups who use, manage, research, live, and visit that marine social-ecological system. Overall, this thesis finds that multiple-use MPAs can support varied dimensions of human well-being. But if benefits and costs are to be equitably shared among diverse stakeholders whose livelihoods depend on the MPA, conservation practitioners need to understand not only how conservation decisions affect biodiversity, but also how they influence the multiple dimensions of well-being of different social groups. For that, inclusive participatory processes at the centre of conservation practice and policy offer promising opportunities to tackle local challenges, reduce conflicts, and increase social support for conservation. Below I report three main findings of this thesis.

First, interactions between cultural practices and Litoral Norte MPA sites support different cultural dimensions of human well-being **(chapter 2)**, with significant differences in levels of well-being explained by socio-economic factors and environmental behaviour. Subjective well-being derived from relating to, interacting with, and experiencing MPA sites can be grouped onto four cultural dimensions of well-being. Based on exploratory factor analysis, I have interpreted these dimensions as *engagement with nature & health*; *sense of place*; *solitude in nature*; and *spirituality*. These cultural dimensions of well-being are not mutually exclusive and may reflect intertwined elements of human well-being.

Second, social and ecological outcomes of MPAs can be perceived differently by distinct stakeholder groups **(chapter 3)**. In Litoral Norte MPA, while managers tended to perceive conservation outcomes more positively, fishers, fish vendors, maritime tourism operators, and scientists, generally had more negative perceptions. This mismatch of perceptions by different stakeholder groups about MPA outcomes is a concern for the future of Litoral Norte. This is because negative perceptions of

conservation outcomes are often associated with lack of support and disapproval of conservation initiatives by local stakeholders.

Third, articulating the perceptions of local MPA users, managers, and scientists into concrete conservation actions can not only increase overall support for the MPA, but also help improve both biodiversity and human well-being **(chapter 4)**. Articulating perceptions into conservation actions requires participatory processes, which enable social learning and communication among stakeholders. It also requires the articulation of different worldviews, perspectives, knowledge types, values, and aspirations. Including stakeholders' contributions into democratically deliberated conservation decisions can increase the legitimacy, compliance, and responsibility of stakeholders towards the decisions made, because the "ownership" of decisions will be of the involved stakeholders. Democratically deliberated conservation decisions involving diverse stakeholder groups are also better prepared to deal with the often-hard trade-offs between marine conservation and human well-being. A just and equitable distribution of costs and benefits inherent to those trade-offs contributes to more balanced decisions for biodiversity and people.

The findings of this thesis offer several insights to conservation practice and policy. One is that subjective well-being assessments can unveil important links between cultural dimensions of well-being and specific MPA sites. By targeting conservation actions at sites that combine exceptional ecological and cultural values, MPA managers can find a practical way of promoting synergies between biodiversity conservation and human well-being. Safeguarding the values of MPA sites that are important to people—and communicating effectively related conservation actions—offer promising opportunities to attract people's support and participation in conservation decisions. People's support and participation are often pre-requisites for successful conservation inititatives.

Another insight is that social and ecological outcomes of MPAs can be inversely perceived by different stakeholder groups. This issue deserves attention considering that social support for MPAs often depends on positive perceptions of conservation

outcomes. In Litoral Norte MPA, conservation managers tended to have positive perceptions about conservation outcomes while the opposite was true for local users and scientists. Understanding the underlying causes of negative perceptions is essential to overcome conflicts. For example, while conservation managers tended to highlight how the MPA was succeeding in safeguarding certain habitats, creating coastal routes for hikers, and stimulating environmental education, fishers and fish vendors regarded the MPA as tool against fishing and a strategy to benefit tourism. Besides managers, all interviewed stakeholder groups linked negative social and ecological outcomes of the MPA to barriers to participation in conservation decisions, limited management capacity, poor planning, and insufficient monitoring. Scientists emphasised the lack of noticeable ecological improvements in Litoral Norte. Overall, the mismatch of perceptions between managers, local users and scientists hinders support for the MPA. Identifying and analysing the reasons that underly negative perceptions of MPA outcomes are first steps to improve conservation actions. A following promising step is considering, discussing, and articulating stakeholder knowledge to solve concrete conservation challenges. While not all stakeholders' perspectives may align with conservation goals, articulating those that do into conservation actions may offer great potential for novel solutions. This is because local practical knowledge is often shaped by the local environment and its specific challenges, and hence local knowledge may provide tailored solutions for local problems.

Participation of local stakeholders in conservation decisions is crucial for conservation success. This is an often-repeated message. And it is easier said than done. But efforts to improve communication and mutual understanding between MPA managers, fishers, fish vendors, tourism operators, scientists, and other relevant stakeholders, can yield positive outcomes for conservation initiatives over the long run. The workshop organised under this thesis supports this assertion. By creating shared narratives of positive future visions—and by developing concrete actions to attain envisaged futures—workshop participants could openly discuss on-going challenges and propose concrete solutions to overcome conflicts. Scaling up and including similar

participatory processes in conservation practice and policy—where marginalised stakeholder groups are represented—can offer more transparent, democratic, and enduring solutions to recurring conservation problems.

Multiple-use MPAs are embedded in complex and dynamic marine social-ecological systems. While there are no panaceas for conservation challenges, embracing uncertainty, fostering humility, and learning from different types of knowledge help to deal with complex social-ecological challenges. The greatest of these challenges is to nurture human flourishing while biodiversity thrives. It's not an impossible goal. But it's a goal that requires acknowledging that human and non-human nature are intertwined and support each other. In other words, this means shifting our mental frames from a "nature for people" to one of "people and nature".

The end.